ECTRICAL REVIEW 27 JANUARY 1961

BACKGROUND TO EXPORTS

ELECTRICAL REVIEW

FRIDAY
ANUARY 1961

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ISH INSULATED CALLENDER'S CABLES LIMITED
OOMSBURY STREET LONDON WC1

today's stock orders . . . get moving today

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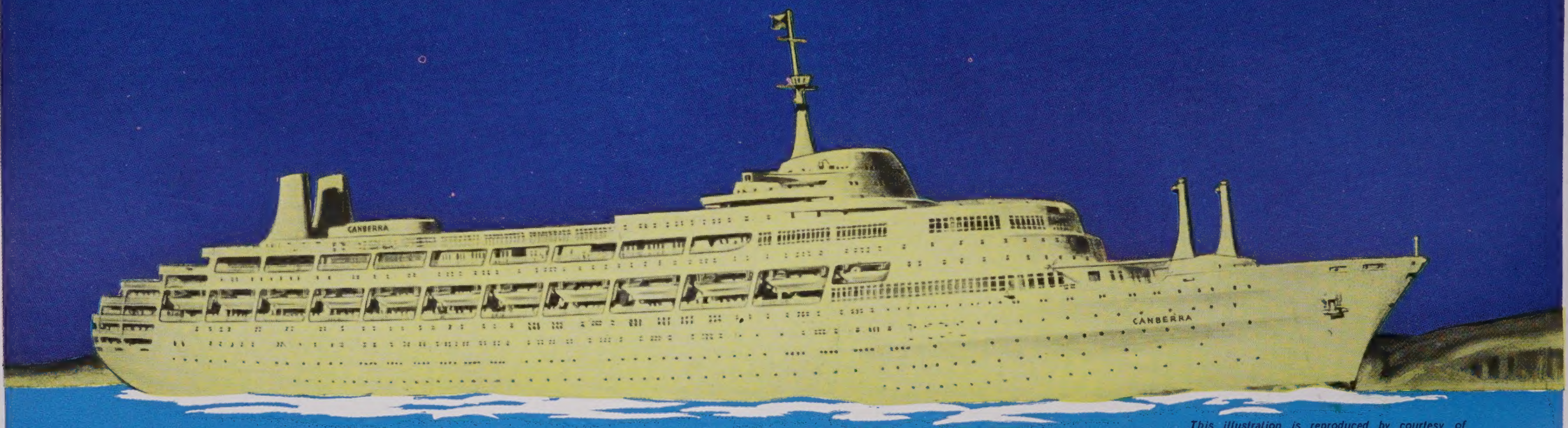


This illustration is reproduced by courtesy of The P & O — Orient Lines and Harland & Wolff Ltd.

The main propulsion motors · AEI (Rugby) Ltd;
Cable and warping capstan motors, store and baggage hoist motors and cargo winch motors · Clarke, Chapman & Co., Ltd;
The automatic helmsman motor · Lancashire Dynamo & Crypto Ltd. for S. G. Brown Ltd;
Carron cargo transporter motor · Bruce Peebles & Co., Ltd. for The Carron Company;
Power cables · AEI (Woolwich) Ltd; Auto-transformer starters · The General Electric Company Limited;
The bilge pump motors · W. H. Allen Sons & Co., Ltd., and other electrical equipment in the "CANBERRA"

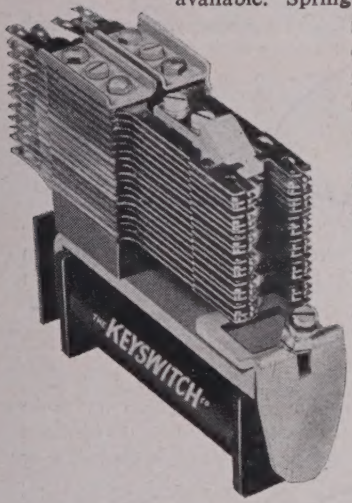
incorporate insulation by **m and i THE ELECTRICAL INSULATION PEOPLE**

THE MICANITE & INSULATORS CO., LTD., Empire Works, Blackhorse Lane, Walthamstow, London, E17. Telephone: Larkswood 5500, Telegrams: Mytilite London Telex, Telex: 25183

Men in the Know
HAVE THE RIGHT CONTACTS

MAJOR TYPE 'BPO 3000'

The best known and most useful relay available. Spring sets allow from one make or break to 12 changeovers. For minute or heavy switching. Sensitivity down to 20 milliwatts. Adjustable for critical timing, fast or slow operation. Standard or Tropical finish. Special adaptations can be supplied.



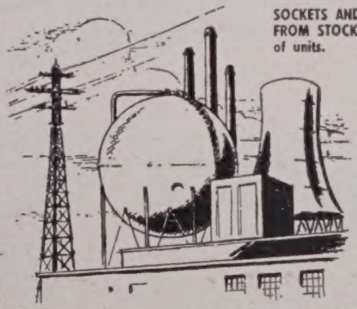
Transparent covers for above now available.

and now PLUG-IN 3000 Type Relays.

Plug-in facilities in addition to all the versatility and well-established, reliable features of the world's best known relays.

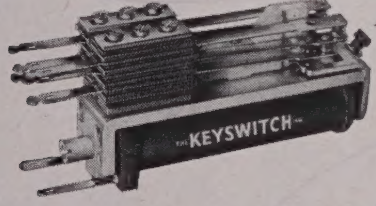
- ★ Positive contact between male and female pins.
- ★ Contacts: up to 18 light duty or 12 heavy duty.
- ★ Complete transistorized units.
- ★ AC or DC operation.
- ★ Transparent or metal cover.
- ★ Clip retains relay positively in any position.

SOCKETS AND FITTINGS ARE AVAILABLE FROM STOCK for immediate assembly of units.



PLUG-IN TRANSISTORIZED UNIT.

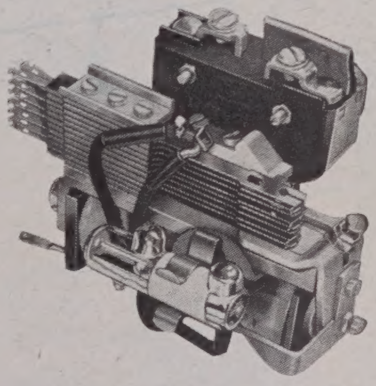
Operation AC or DC. Switching or Signal Current AC or DC. 5 to 500 micro-amps. Transfer switching current 10 amps. or 500v.



MINOR TYPE '600' (Fitted with double pole changeover for 250 volts 2 amps.)

Ideal for simple switching operations where lightness, compactness and economy are prime considerations. When fitted with contacts similar to those of the 'B.P.O. 3000' type it is faster in operation and release.

This relay incorporates 15 amp. Micro Switch; 5 amp. Mercury Switch and standard 0·3 to 8 amp. contacts.



Available free on request, unique calculator providing full relay specifications

KEYSWITCH RELAYS

Sales Director:
2 Irongate Wharf Road, Praed Street,
London, W.2
Telephone: PADdington 2231

Extremely advantageous quotations can be offered for quantity orders.
Contractors to Home and Overseas Governments and H.M. Crown Agents.

RELAYS FOR ALL PURPOSES can be manufactured to customers' requirements for :—

- **AUTOMATION**
- **COMPUTERS**
- **BATCH COUNTING and PHOTO-ELECTRICS**
- **TELEPHONY and INTERCOM SYSTEMS**
- **AUTO-TIMING and AUTOMATIC SIGNALS**
- **MOTOR and MACHINERY CONTROL**
- **CURRENT and VOLTAGE REGULATION,**

Etc.

VAST

TECHNICAL EXPERIENCE

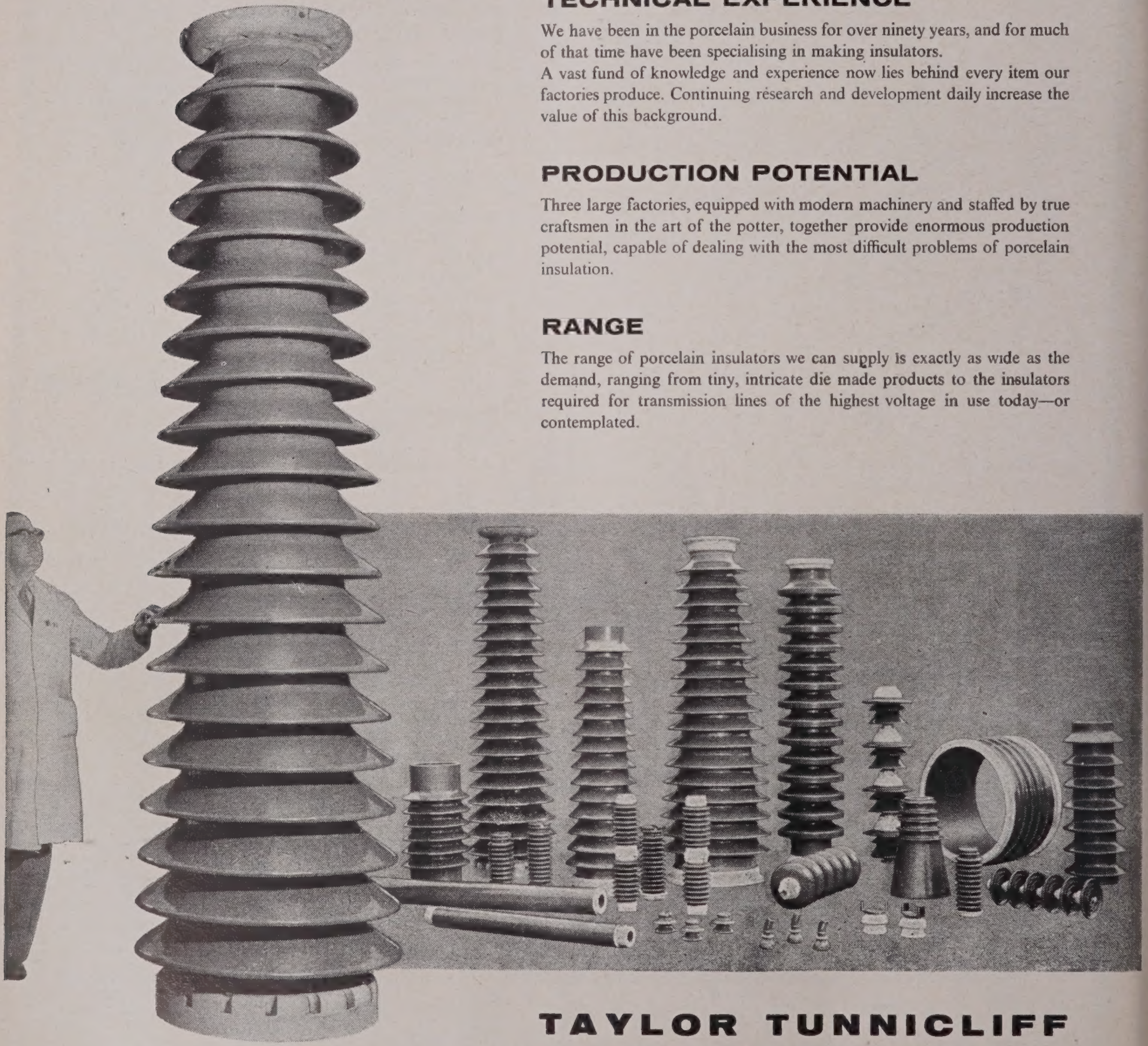
We have been in the porcelain business for over ninety years, and for much of that time have been specialising in making insulators.
A vast fund of knowledge and experience now lies behind every item our factories produce. Continuing research and development daily increase the value of this background.

PRODUCTION POTENTIAL

Three large factories, equipped with modern machinery and staffed by true craftsmen in the art of the potter, together provide enormous production potential, capable of dealing with the most difficult problems of porcelain insulation.

RANGE

The range of porcelain insulators we can supply is exactly as wide as the demand, ranging from tiny, intricate die made products to the insulators required for transmission lines of the highest voltage in use today—or contemplated.



TAYLOR TUNNICLIFF PORCELAIN INSULATORS

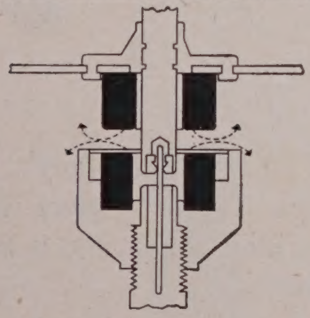
POSITIVE PROOF ALL OVER THE WORLD

TAYLOR TUNNICLIFF & CO., LTD
Head Office: EASTWOOD, HANLEY, STOKE-ON-TRENT. Tel: Stoke-on-Trent 25272/5
London Office: 125 HIGH HOLBORN, LONDON, W.C.1. Tel: HOLBORN 1951-2

SANGAMO FIRST AGAIN!

NEW MAGNETIC FLOTATION OF DISC ASSEMBLY

eliminates lower-bearing wear



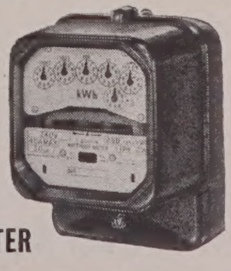
Two cylindrical Barium-ferrite ceramic magnets, of high coercive force, act with opposing magnetic fields to float the disc completely on a magnetic cushion having a generous clearance of approximately $\frac{1}{16}''$ in depth. These magnets, which are surrounded by Mu-temp metal to give full temperature compensation over a range —40°C to +80°C, act as weight neutralizers. Because there is no load or thrust there is virtually no bearing to wear or replace. Accuracy is sustained . . . and maintenance is eliminated.

* New "Floton" bearing gives complete magnetic flotation of disc assembly.

* Even longer life. * No maintenance.

* Unlimited sustained accuracy.

Sangamo are first in production with magnetic flotation of the disc assembly, completely eliminating bearing wear, giving even longer life and sustained accuracy to the world's longest life meter.

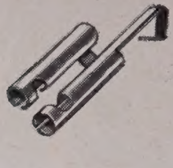
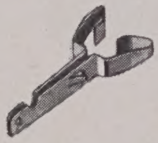
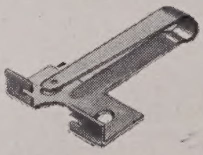


sangamo S200.16 SINGLE PHASE WATTHOUR METER

SANGAMO WESTON

SANGAMO WESTON LIMITED · ENFIELD · MIDDLESEX
Telephone: Enfield 3434 (6 lines) & 1242 (6 lines) Telegrams: Sanwest, Enfield

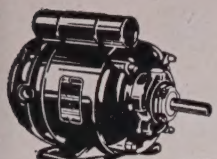
SW 122

The great merit  of beryllium-copper is that in its soft state it can be formed into springs of complex shape and then  given spring temper by a simple heat  treatment

Booklet 1073, " Mallory 73 Beryllium Copper " gives full technical information, and is free on request.

Johnson MALLORY Matthey

JOHNSON, MATTHEY & CO., LIMITED, controlling MALLORY METALLURGICAL PRODUCTS LTD.
73-83 HATTON GARDEN, LONDON, E.C.1. Telephone: Holborn 6989
Vittoria Street, Birmingham, 1. Telephone: Central 8004 *75-79 Eyre Street, Sheffield, 1. Telephone: 29212*



THEY ALL CHOSE AEI FRACTIONALS

... I wanted a totally enclosed fan-cooled motor
I wanted a two-pole motor ...
... I wanted a split-phase 'fractional' with flanged endshield

Whatever the project, if you are producing machinery to be powered by a.c. or d.c. motors of up to one h.p., consult AEI engineers at the design stage. The wide choice of fractionals they can offer gives you greater scope for producing machinery of improved design and performance. AEI experts have almost certainly met problems similar to yours already, and their valuable experience and knowledge are at your service.

OUR ADVISORY SERVICE FOR DESIGNERS
will save you time and trouble!

Consult AEI engineers *at an early stage* and make sure of getting the *right* f.h.p. motor for the job! Many types and sizes from 1/500 h.p. are available, with every conceivable kind of mounting or fitting, and many of these are available from stock. You can thus combine maximum efficiency and reliability with the most compact, practical, and attractive design.

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Motor and Control Gear Division
F.H.P. MACHINES SALES
NEWCASTLE, STAFFORDSHIRE, ENGLAND

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MK 181 DHB

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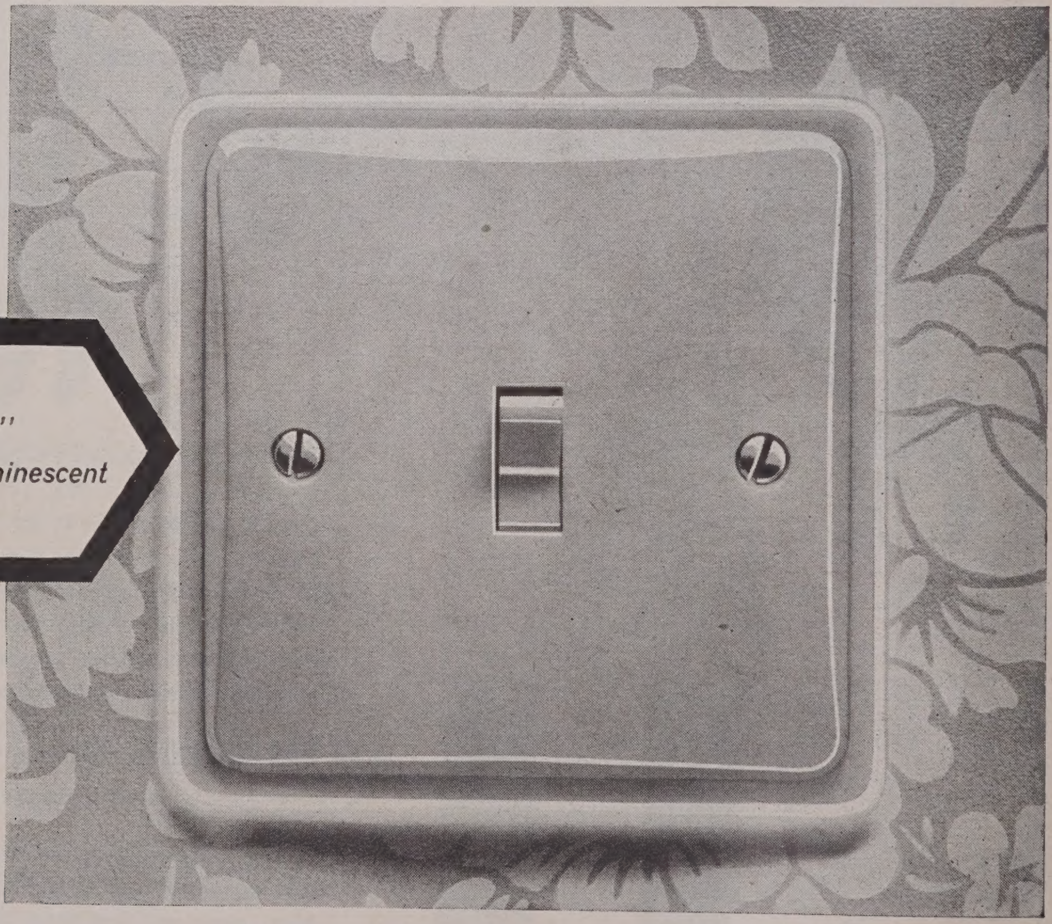
LUMINOUS LOCATOR

A new approach to Switch and Socket finding — in darkness



Ask for Leaflet No. 256

The M.K. Luminous Locator is the solution to the problem of detecting in darkness the exact location of Switches, Socket-Outlets and other accessories.

The Locator is placed between the wall and the plate of any flush accessory (accommodated in a flush box to BS 1299/1363 and having 2⅜″ fixing centres).

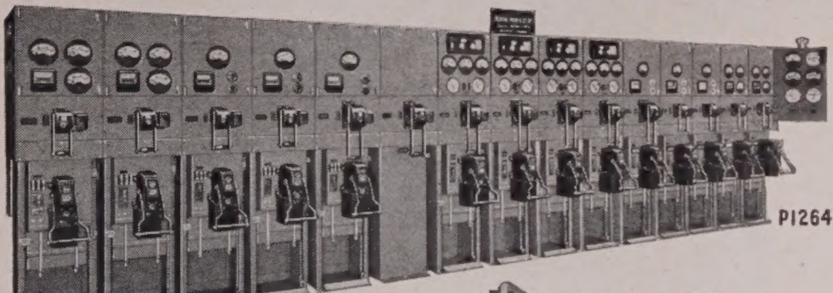
The Locator emits in darkness a bright green electroluminescent glow all around the accessory and pin-points its position. Permanent in effect — does not require light replenishment and current consumption is negligible.

The Locator in daylight is a pleasing ivory colour and is contained within a transparent moulded frame which also serves as a finger-shield to prevent soiling of decorations around the accessory.

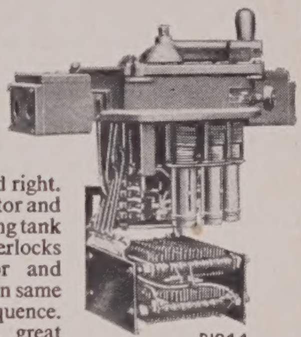
M.K. ELECTRIC LIMITED, SHRUBBERY ROAD, LONDON, N.9. EDMonton 5151

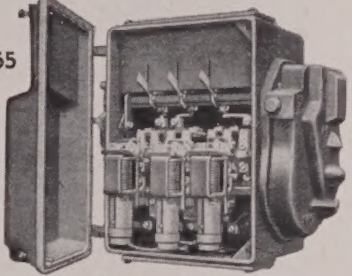
WE ARE SPECIALISTS IN SWITCHGEAR & MOTOR CONTROL GEAR

SWITCHBOARDS & HAND-OPERATED MOTOR CONTROL GEAR


P1264

P1264 Illustrated left, Switchboard recently supplied for controlling diesel Alternator Sets and Feeders at a large Sewage Works. This Switchboard is of the duplicate busbar type and contains circuit breakers ASTA certified at 25 MVA to BS. 116 at 400 volts.

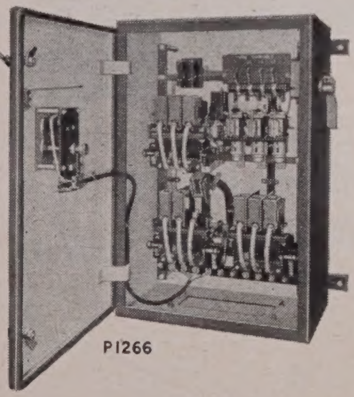

P1044


P. 955

P 955 Illustration on the right is of a hand-operated air break star delta starter, fitted with interlocked isolator and solenoid type overloads with time lags. This starter can also be supplied as a direct-on starter.

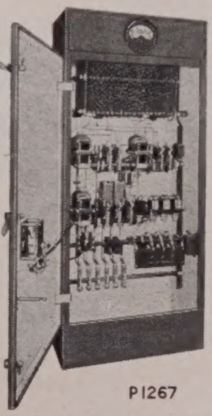
P1044 Illustrated right. Combined type stator and rotor starter showing tank removed. No interlocks required as stator and rotor contacts are on same drum in correct sequence. There is also a great saving in floor space.

CONTACTOR TYPE SWITCHGEAR & MOTOR CONTROL GEAR


P1266

P 1327 Illustrated right, multi motor contactor type Switchboard recently supplied for controlling air conditioning and refrigeration plant in the Middle East.

P 1327


P1267

P1266 Starter illustrated above is one of our CS. 30 pattern star delta starters, suitable for use up to 20 H.P. This type of starter is made in different ranges up to 250 H.P.

P1267 Starter illustrated at the left is a 50 H.P. CS. 75 type stator and rotor starter. This starter is made in different ranges up to 250 H.P. All our contactors above the CS. 15 size are bar mounted with powerful magnetic blowouts.

WE MANUFACTURE :- **L.T. SWITCHGEAR 50/7,000 Amperes. E.H.T. SWITCHGEAR up to 11 kV. 250 MVA rupturing capacity. MOTOR CONTROL GEAR ¼/5000 H.P.**

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SWITCHGEAR SPECIALISTS

Head Office & Works
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London Office
GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

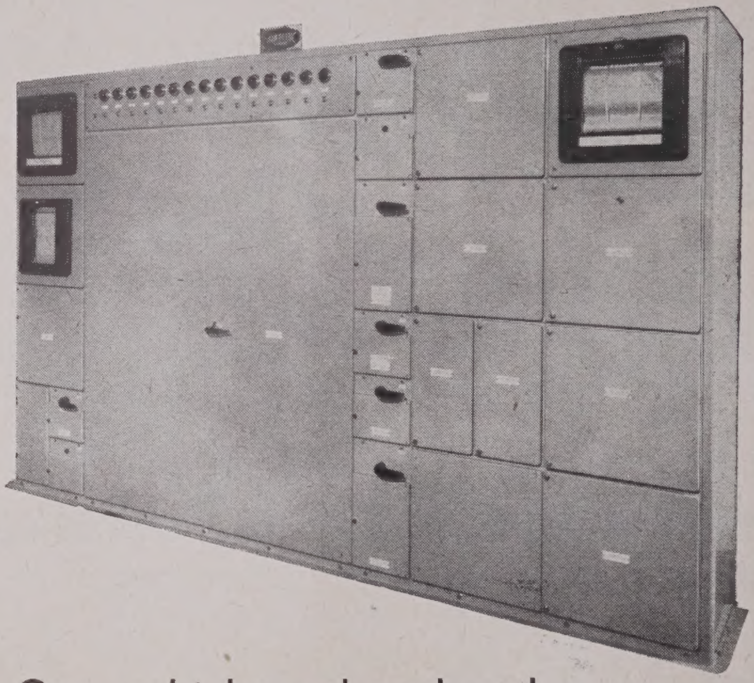
BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

May we have your enquiries?

730

WELCOME TO OUR STAND NO. A9, ELECTRICAL ENGINEERS EXHIBITION, EARLS COURT, LONDON, MARCH 21st—25th

VARILECTRIC cubicle switchboards



Our cubicle and pedestal type switchboards are flexible in design, neat, compact, are front access for wiring and save money

Our range includes—

- DISTRIBUTION FUSEBOARDS WITHOUT AND WITH BUILT-IN ISOLATORS
- RISING MAIN BUSBARS WITH ASSOCIATED FLOOR DISTRIBUTION EQUIPMENT INCLUDING FLOOR HEATING CONTROL
- OVERHEAD BUSBARS WITH PLUG-IN FUSED TAP OFFS
- SHEET STEEL CABLE TRUNKING
- UNDERFLOOR AND SKIRTING DUCTING
- MULTI-TIER MOTOR CONTROL PANELS

Our fused switchgear is being installed in **S. S. CANBERRA**

VARILECTRIC
LIMITED

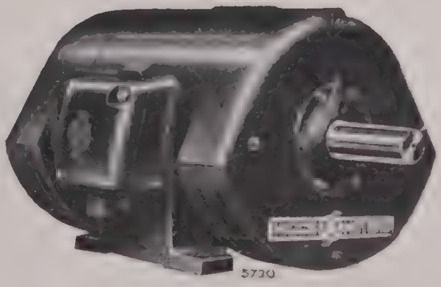
10 MELON ROAD
LONDON, S.E.15
Telephone : RODney 6895/6/7
Telegrams and Cables : Varitric, London, S.E.15

TRADE MARK

HIGGS MOTORS LTD.

MANAGING DIRECTOR DAVID C.Y. HIGGS, A.M.I.E.E.

BIRMINGHAM 6 ENGLAND



DRIP PROOF MOTORS

STANDARDISED DIMENSIONS
CLASS 'E' INSULATION
COMPLYING WITH B.S.2613

BELFAST · BRISTOL · CARDIFF · DUBLIN · DUNDEE · GLASGOW · HULL · LEEDS · LIVERPOOL · LONDON
MANCHESTER · NEWCASTLE · PETERBOROUGH · SHEFFIELD · WOLVERHAMPTON

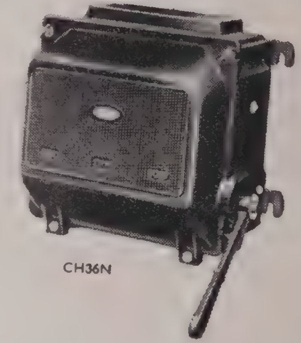
'CH' FUSED SWITCHES

DENNIS
TYPE 'H'

STANDARD PATTERNS

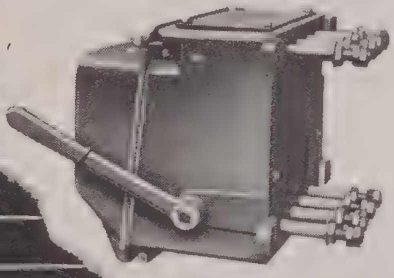
FRONT CONNECTED PATTERN SWITCHES

The normal standard type is known as the front connected pattern and is for use as a loose unit or for mounting above or below ducts or busbar Chambers. The catalogue prefix is "CH" or "CS" according to whether the switch is fused or not.



CH36N

BACK CONNECTED PATTERN SWITCHES



CH320N/B

This pattern is the standard switch provided with insulated screwed stems protruding through the back of the switch complete with locknuts. This type is for mounting on the front of cubicles so that connections of either cable or solid copper can be made to the back of the switch inside the cubicle. The catalogue prefix is CH—/B or CS—/B.

NEL MOUNTING SWITCHES

ew development enabling us
switchboards incorporating
y economical prices, and
ompletely flush fronted
ppearance. Our
d a steel panel
protruding
d by a cast
hutter to
erat-
th-

Take a leaf from the Dennis 'book'

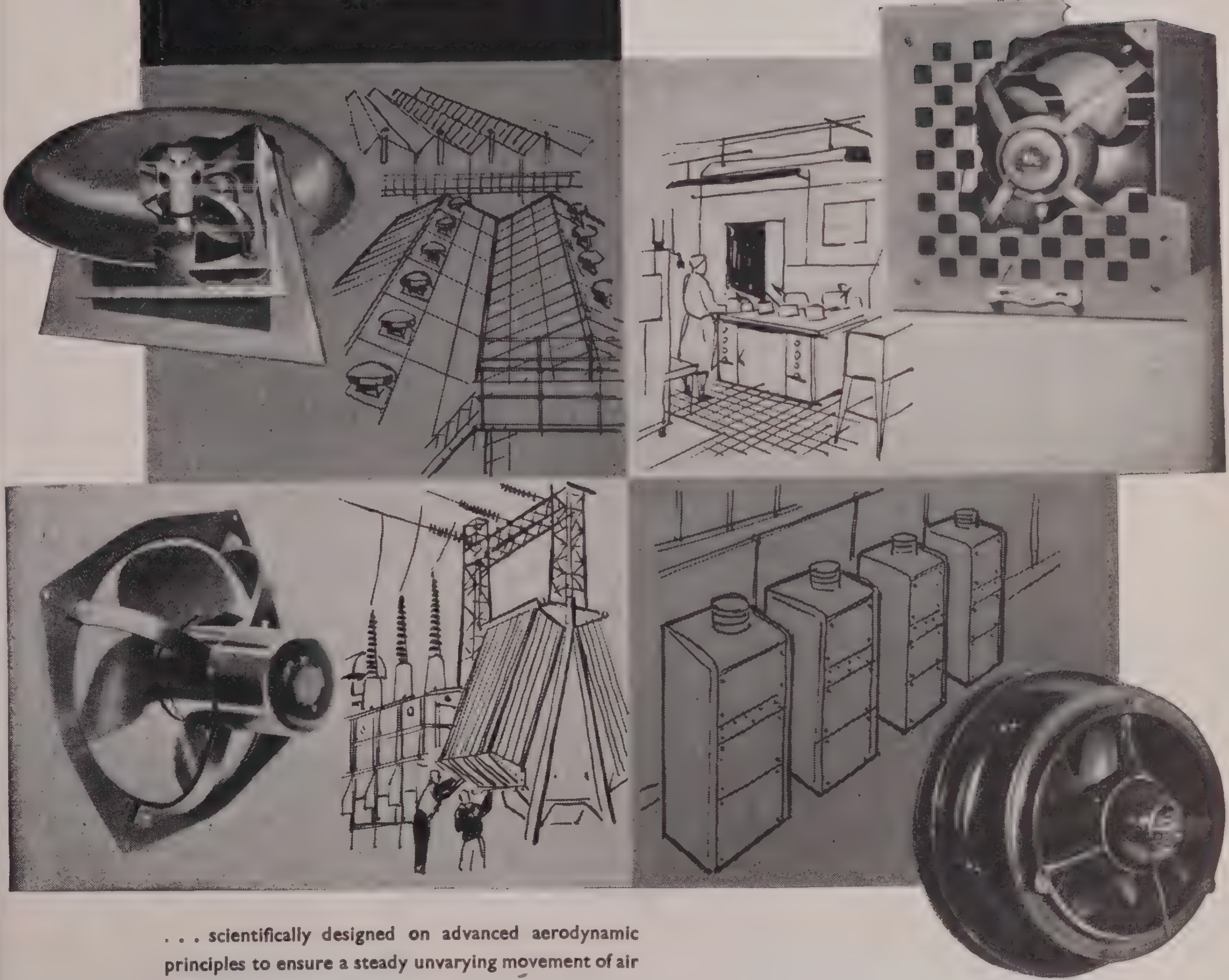
DENNIS

All users of electrical switchgear, Contractors and Wholesalers, should keep a copy of the Dennis Catalogue, M.C.4, handy for constant reference. This gives comprehensive information of the full range of Dennis Switchgear which is readily available to meet the everyday demands of the Electrical Engineer.

G. P. DENNIS LIMITED SPEKE LIVERPOOL *Telephone: Hunts Cross 2241 (5 lines)*
LONDON OFFICE: 417 GRAND BUILDINGS - TRAFALGAR SQUARE - LONDON W.C.2
GLASGOW OFFICE: 125 WEST REGENT STREET, GLASGOW

CVS-29

FANS for every purpose....



. . . scientifically designed on advanced aerodynamic principles to ensure a steady unvarying movement of air unaffected by external conditions.

In addition to manufacturing standard ranges of fans, Fenton Byrn will always welcome this opportunity to consider and manufacture fansf or special purposes. You are invited to submit your enquiries and proposals to the Fenton Byrn Research and Development Department.

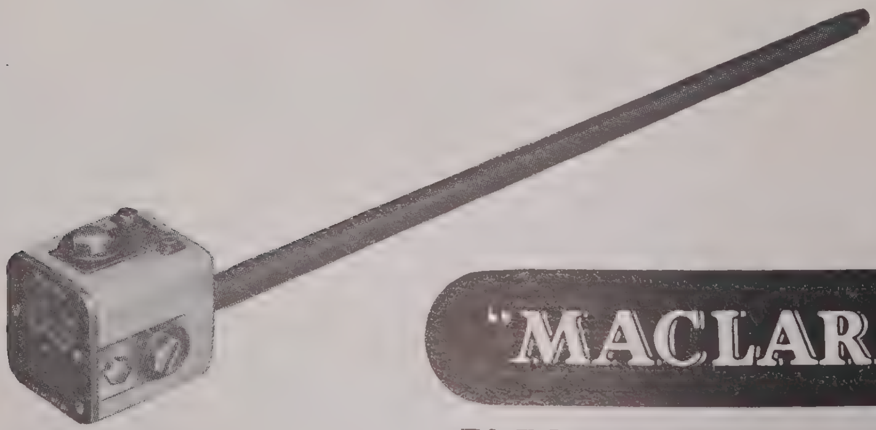
FENTON BYRN & COMPANY LIMITED

AIR-FLOW WORKS - BERRYLANDS - SURBITON - SURREY *Phone ELMbridge 6724 (5 lines) Cables AIRLATION SURBITON Grams AIRLATION SURBITON*

P.3202

Trust a Maclaren!

Yes! trust a MACLAREN to be foremost! Seriously speaking, manufacturers do. That's why 95% of all leading manufacturers of Immersion Heaters and Thermal Storage Water Heaters have dependable, long-lasting MACLAREN MB Thermostats installed as standard equipment. When it's new, or when it's time to renew, specify the thermostat you can trust—it's a MACLAREN!



"MACLAREN"

ELECTRIC THERMOSTATS

ROBERT MACLAREN & CO. LTD., EGLINTON WORKS, KILBIRNIE STREET, GLASGOW, C.5

London Office: *75 George Street, Portman Square, W.1.* **Manchester Office:** *120 126 Portland Street, Manchester 1.* **Midlands Office:** *61 Bridge Street, Walsall*

PHILIPS

streamlite

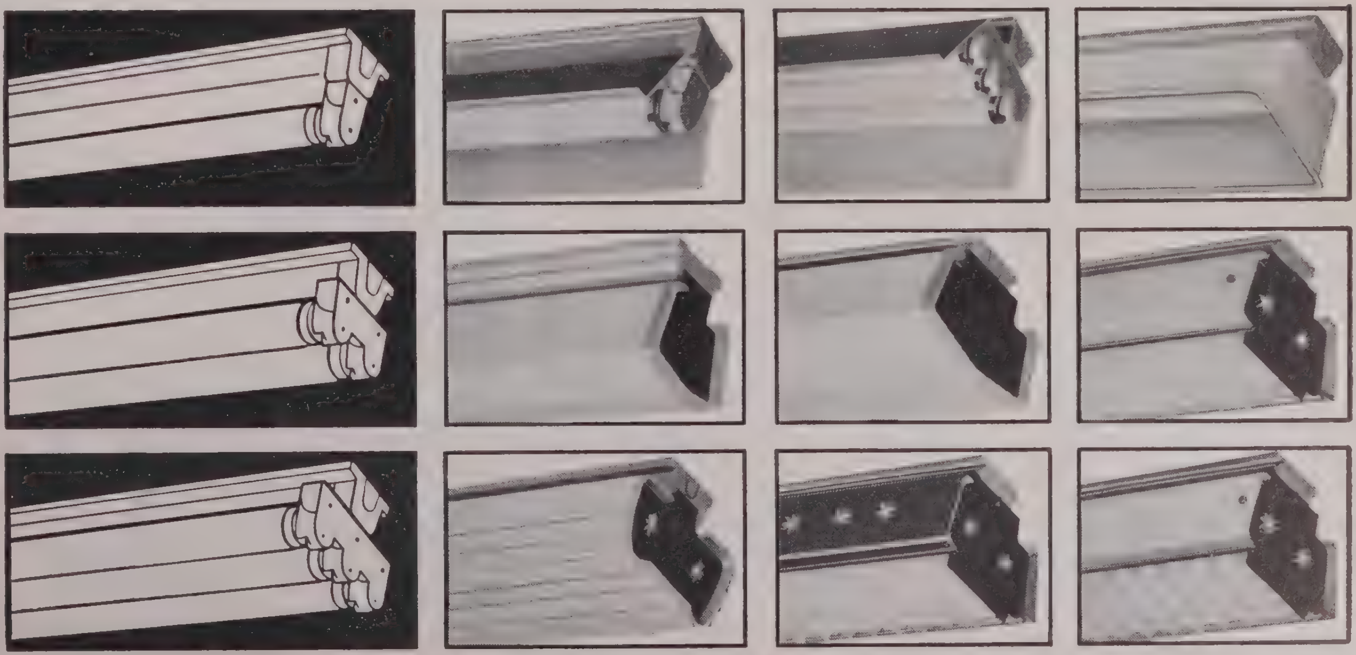
is here!

The newest, slimmest lighting fittings for 1, 2 and 3 lamps 5ft. 80w (1 & 2 lamps 2ft. 20w, 4ft. 40w) – with a big range of reflector and diffuser attachments

Philips Streamlite – it's the newest thing in fluorescent lighting fittings. And it outdates every other type of fitting on the market. For Philips Streamlite – so slim, so sleek, so stylish – has far more to offer than any other fluorescent fittings you can buy, including some advantages that are as unique as they are striking:

- *Philips Streamlite gives you Switch and Switchless start in the popular sizes.*
- *There is a choice of one, two or three lamp fittings – all equipped with Philips even slimmer Polyster ballasts.*
- *There is a fine range of diffusers and reflectors.*
- *It is extraordinarily reasonable in price.*
- *B.S. Box fixing and conduit entries at 24" centres. (B.S. 2467) 2 ft. 20w. 17½" centres.*
- *Variable fixing centres for B.S. Boxes where used with slide-grip hangers.*
- *For single and continuous mounting.*
- *Philips Sprung Rotor lampholders with earth plungers for lamp end-caps – rapid fixing, automatic positioning.*
- *10 amp. mains terminal block, and earth connection.*
- *Full length back plate with rigidly secured cast alloy ends providing earth continuity for end-entry conduit.*
- *Easily removed plastic inserts for end-conduit entries.*
- *Cable way for through wiring: cable cleats provided.*

They'll be in big demand – order now!



PHILIPS LEAD THE WORLD IN LIGHTING

PHILIPS ELECTRICAL LTD · CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON WC2
(LD3284J)

33-kV 1000-MVA, compound-filled, metalclad switchboard

POWER STATION SWITCHGEAR IN SOUTHERN RHODESIA

3·3-kV air-break circuit-breakers and a 480-volt auxiliary board

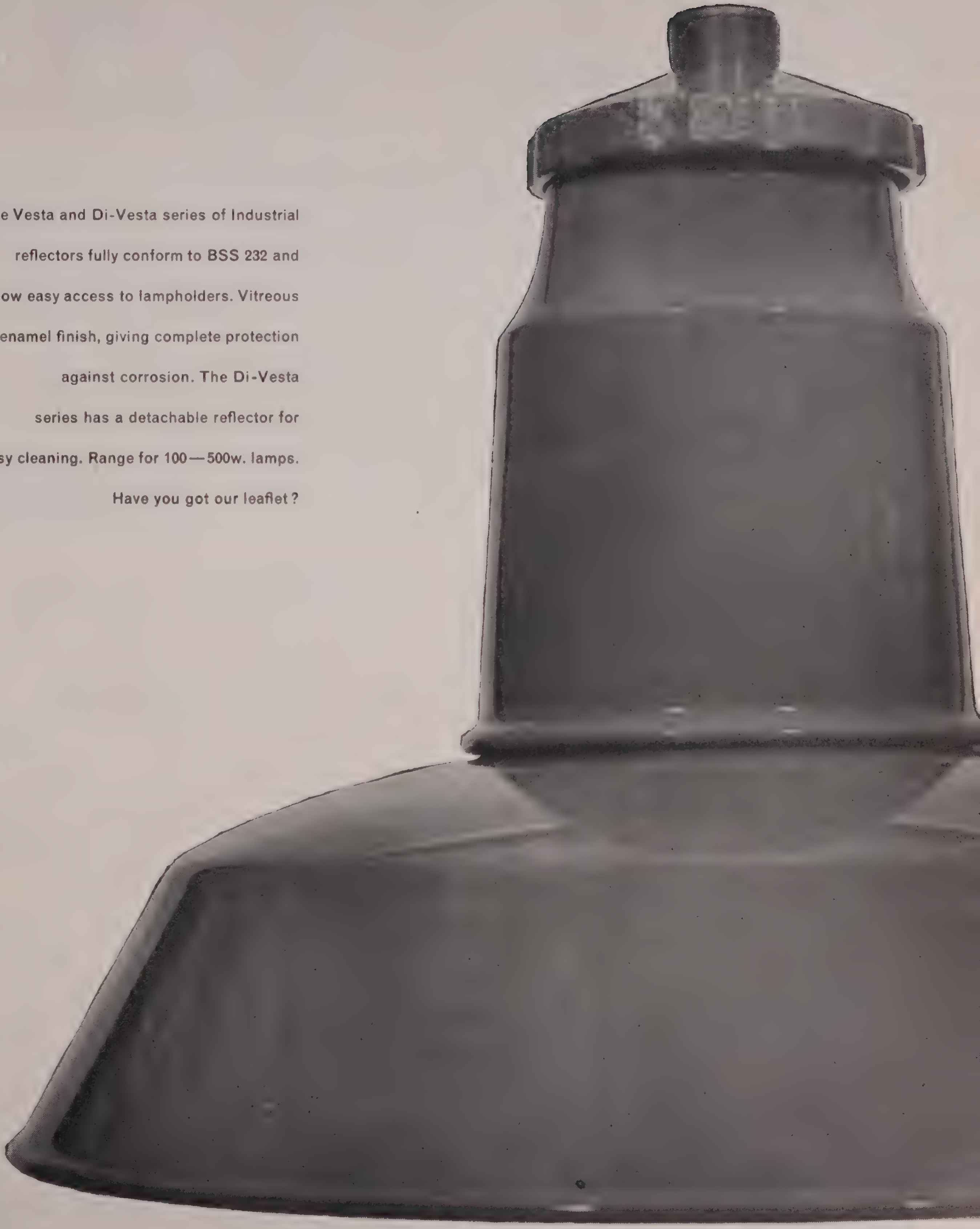
Consulting engineers.
Messrs. Merz and McLellan

Reyrolle supplied the main and auxiliary switchgear and control equipment for No. 3 power station for the CITY OF SALISBURY Southern Rhodesia.

Reyrolle

A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND

. . . The Vesta and Di-Vesta series of Industrial reflectors fully conform to BSS 232 and allow easy access to lampholders. Vitreous enamel finish, giving complete protection against corrosion. The Di-Vesta series has a detachable reflector for easy cleaning. Range for 100—500w. lamps. Have you got our leaflet?



REVO ELECTRIC

REVO ELECTRIC CO. LTD., TIPTON, STAFFORDSHIRE

A Duport Company famous for cookers, fires, fluorescent and industrial light fittings, power tools, street lighting, switch and fusegear etc.

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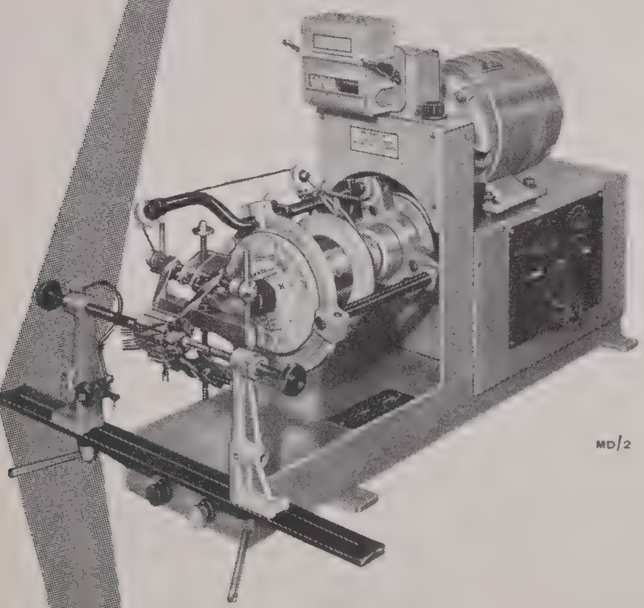
ADD EFFICIENCY TO ELECTRICITY
with this specially designed, sturdy, dependable

Quickway

ARMATURE WINDING MACHINE

(Model 2B MK II)



Re-designed and improved, and incorporating a new infinitely variable speed D.C. drive which provides smooth stepless variations of up to 1000 turns per minute. Bench mounted for use on standard single phase supply, the D.C. voltage being obtained from integral rectifiers. Dynamic braking gives a constant retarding torque over winding speed range and is controlled by automatic turns counter.

Capacity: 45-24 SWG wire size
3″ core diameter
2½″ core length

Send for further details of this handy dependable machine to:

MDC LTD

MIDLAND DYNAMO CO. LTD.
Quickway Works
Leicester

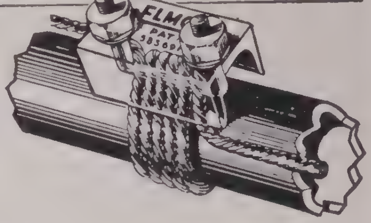
"ELMO"

EARTHING CLAMPS

A COMPLETE RANGE TO B.S.951. 1948 IN 4 SIZES

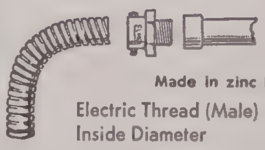
	A123	B45	C67	D8910
for earthing cables up to	7/0.036″	7/0.064″	19/0.064″	19/0.083″
to fit B.S. conduit sizes	1, 2 & 3	4 & 5	6 & 7	8, 9 & 10
i.e. in trade terms	½″ to ¾″	1″ and 1¼″	1½″ and 2″	2¼″ to 3½″

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029″ and for B.S. conduit sizes 1—5.



"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.

ELECTRICAL FITTINGS



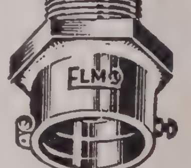
Flexible-to-rigid

CONDUIT COUPLINGS

Made in zinc base alloy in the following sizes:

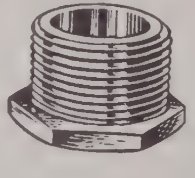
Electric Thread (Male)	⅝″	¾″	1″	1¼″	1½″	2″
Inside Diameter	⅝″	¾″	1″	1¼″	1½″	2″

Electric Thread (Male)	⅝″	¾″	1″	1¼″
Inside Diameter Flexible Conduit	½″	⅝″	¾″	1″



WITH EARTHING TERMINAL

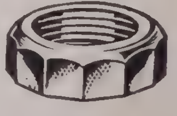
Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal Threads suit all makes of flexible tubing.



MALE
Hex. Section

CONDUIT BUSHES

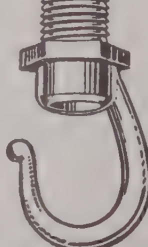
Made in the following sizes:
MALE: Electric Thread
⅝″ ¾″ 1″ 1¼″ 1½″ 2″
FEMALE: Electric Thread
⅝″ ¾″ 1″ 1¼″ 1½″ 2″



FEMALE
Flat Face Section for Spanner (except ¾″ size which is round)

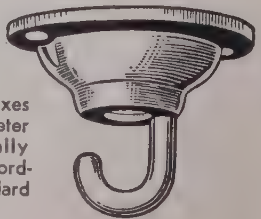
CONDUIT HOOK

For fluorescent lamps and overhead lighting fittings. Screwed ¾″ thread, male electric. Made to fit all standard boxes with two holes 7/32″ diameter —2″ centres diametrically opposed. Designed in accordance with British Standard Specification.



CEILING PLATE

One hook



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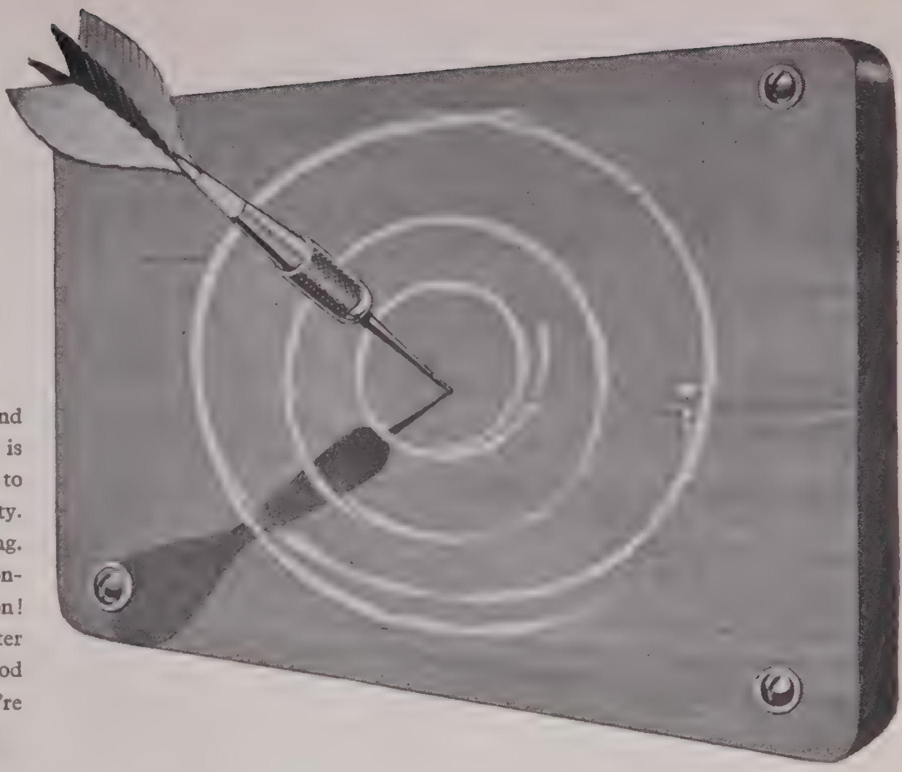

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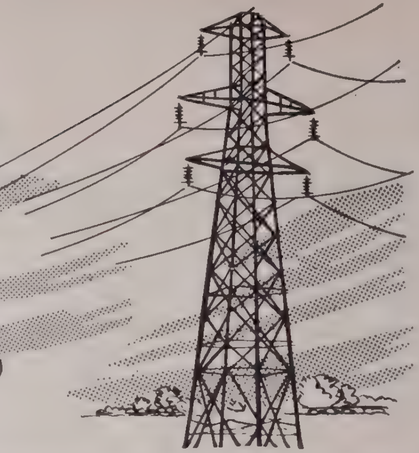

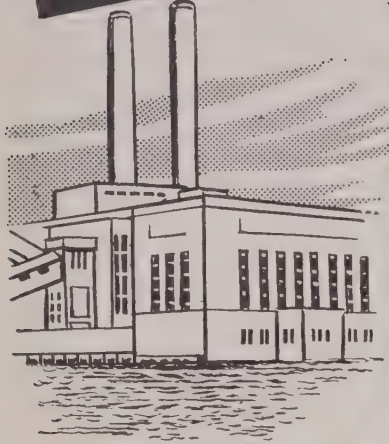

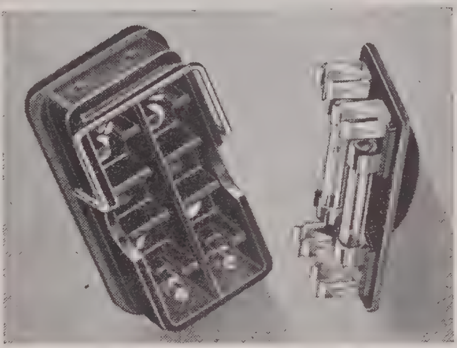

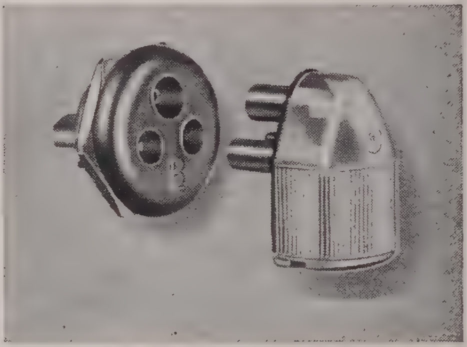

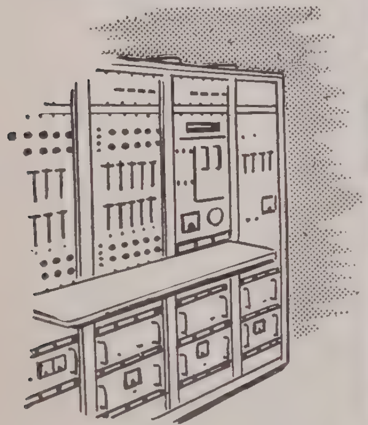

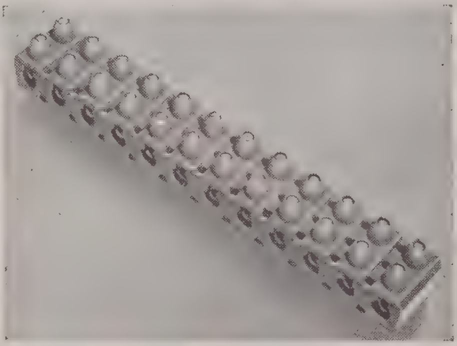

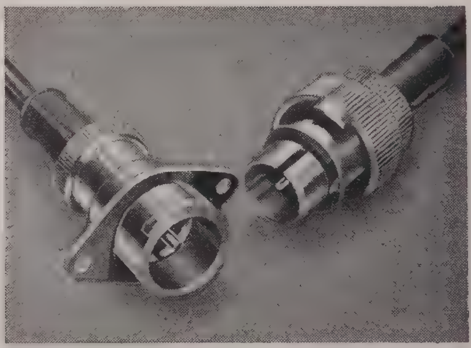

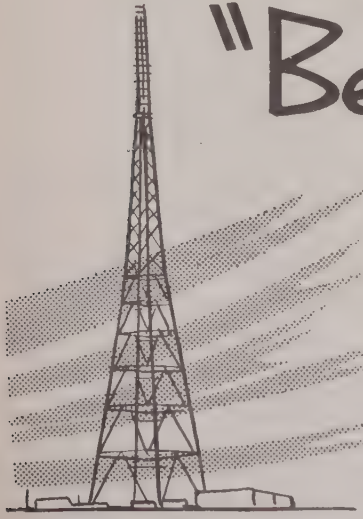

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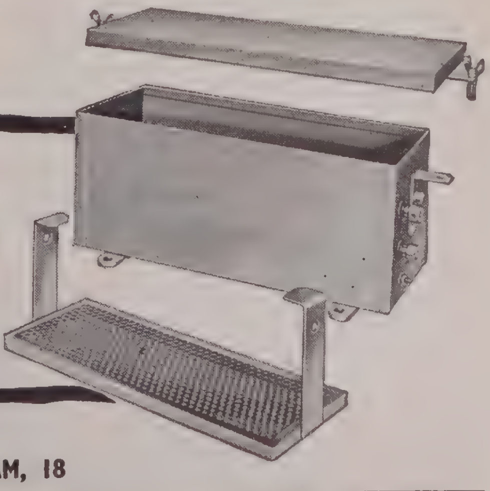

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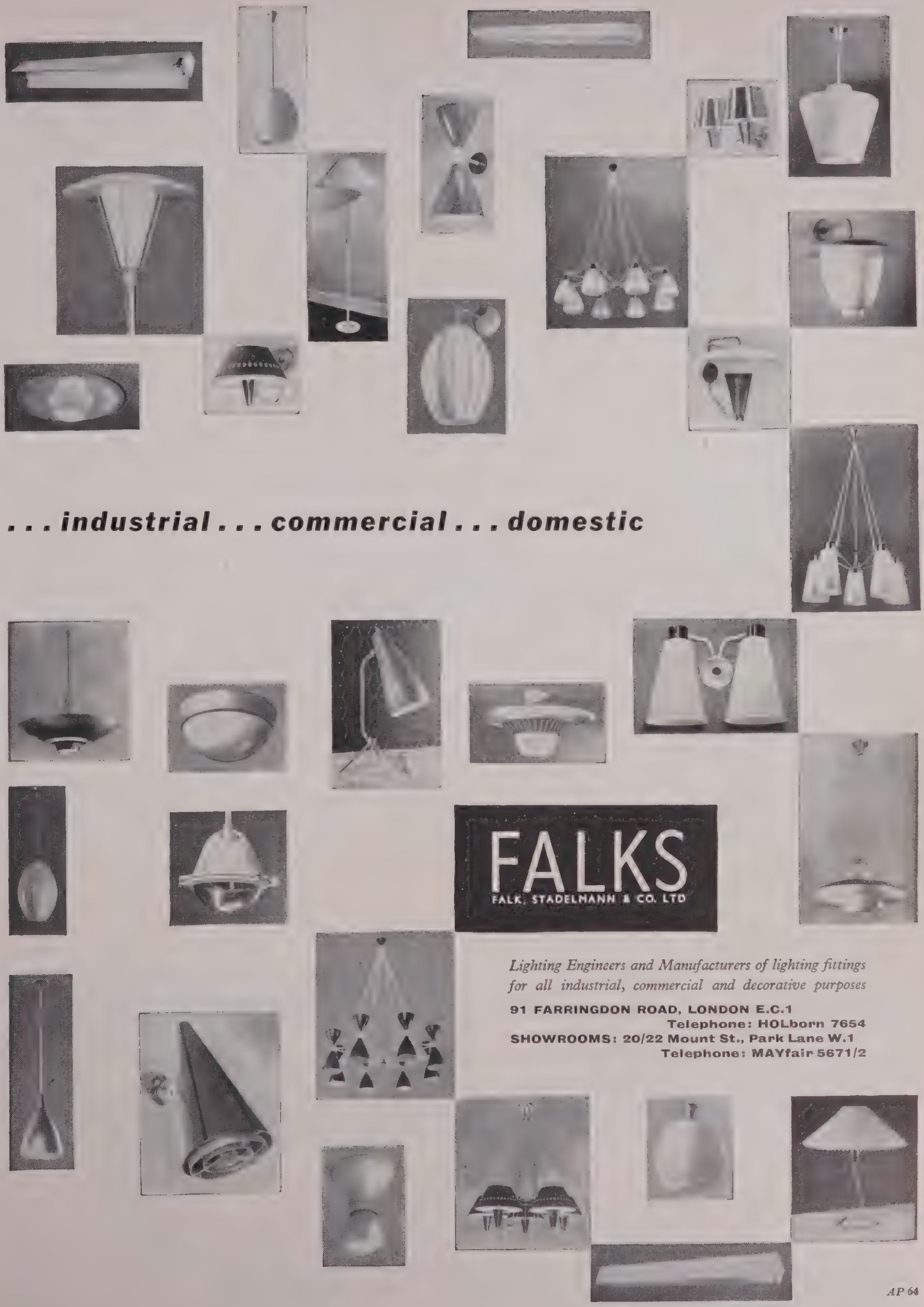

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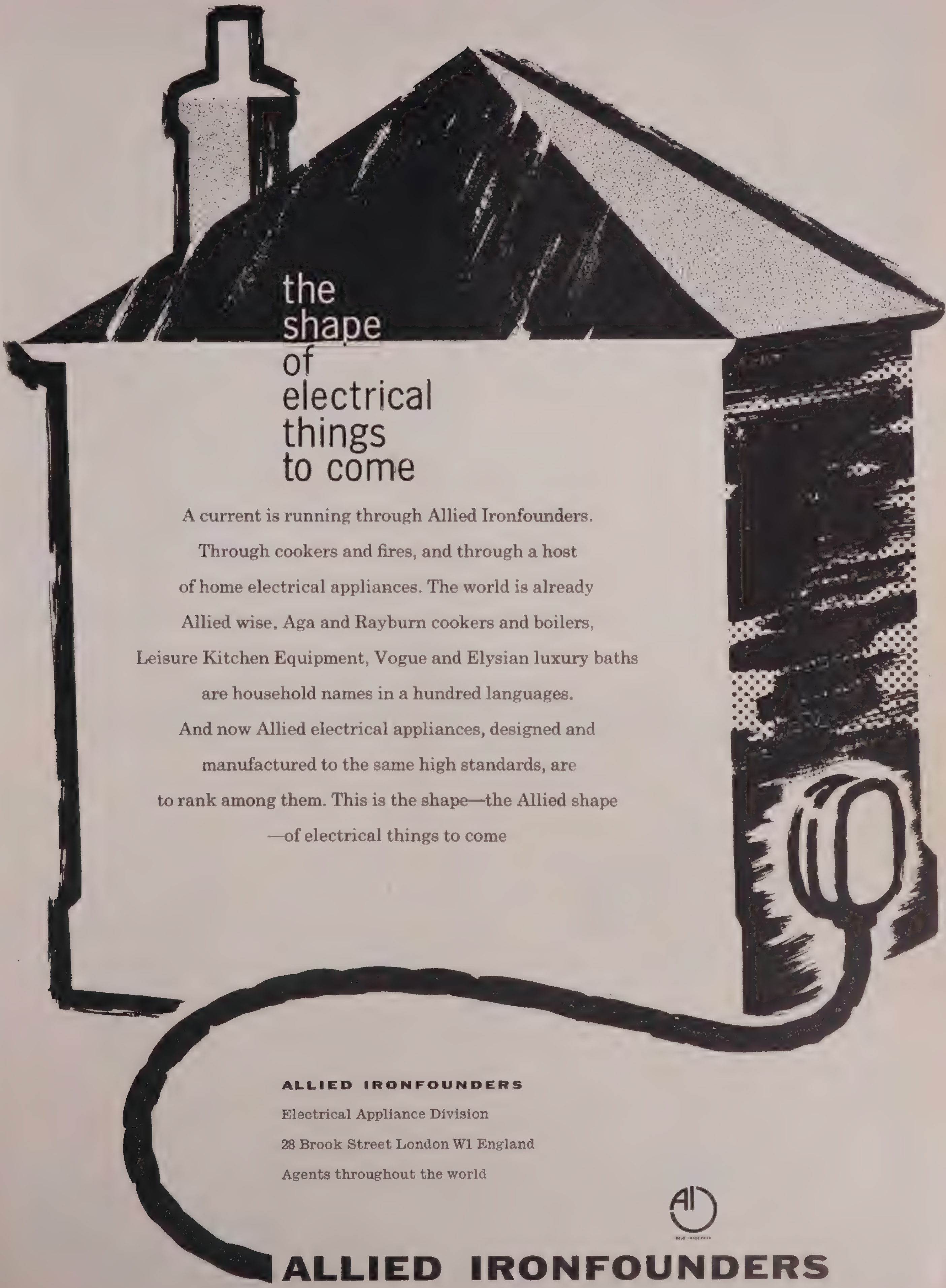
the shape of electrical things to come

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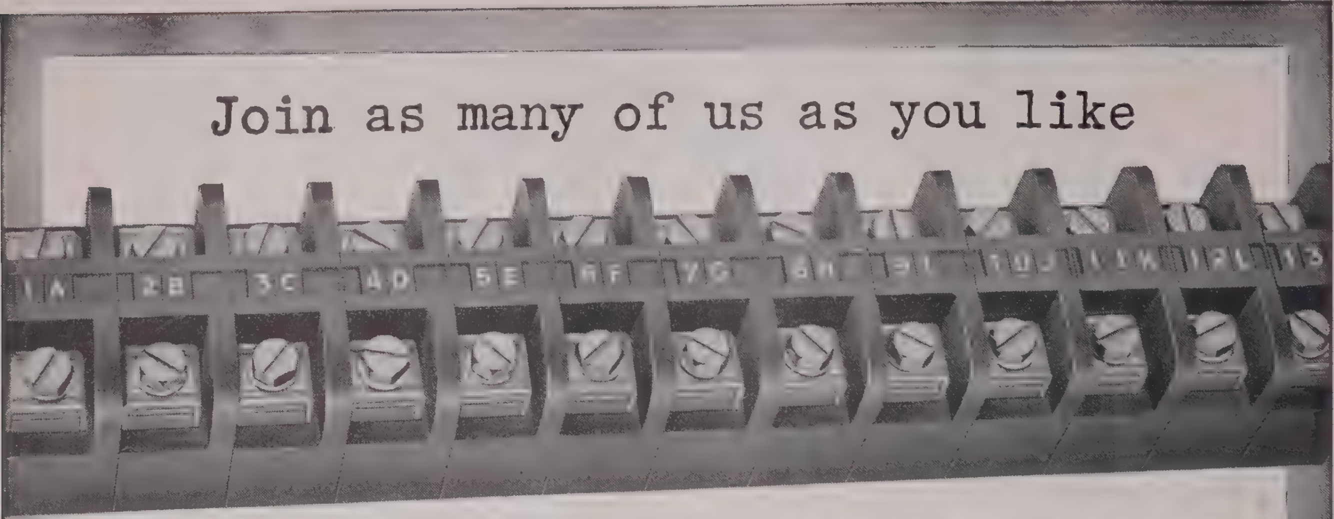
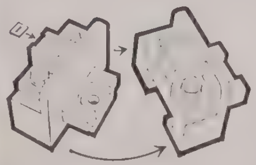


MTE MULTI-LOCK TERMINAL BLOCKS



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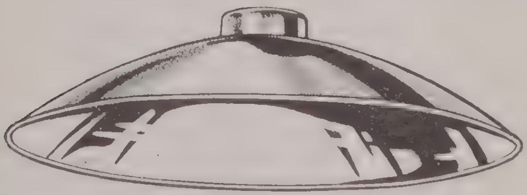

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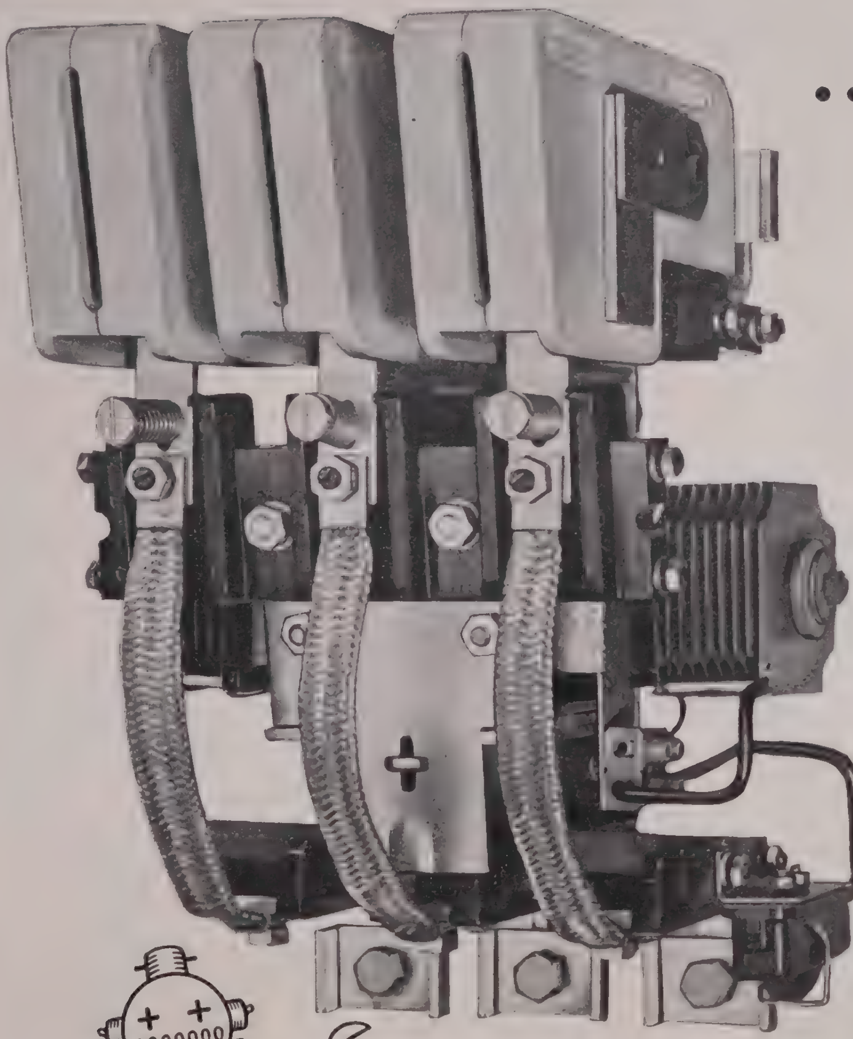

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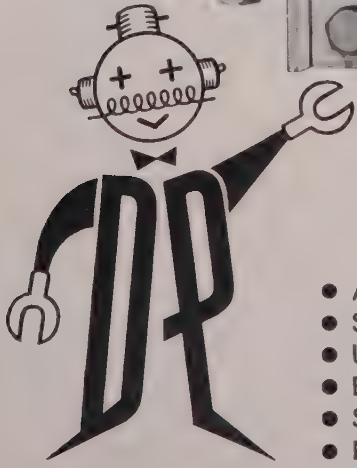

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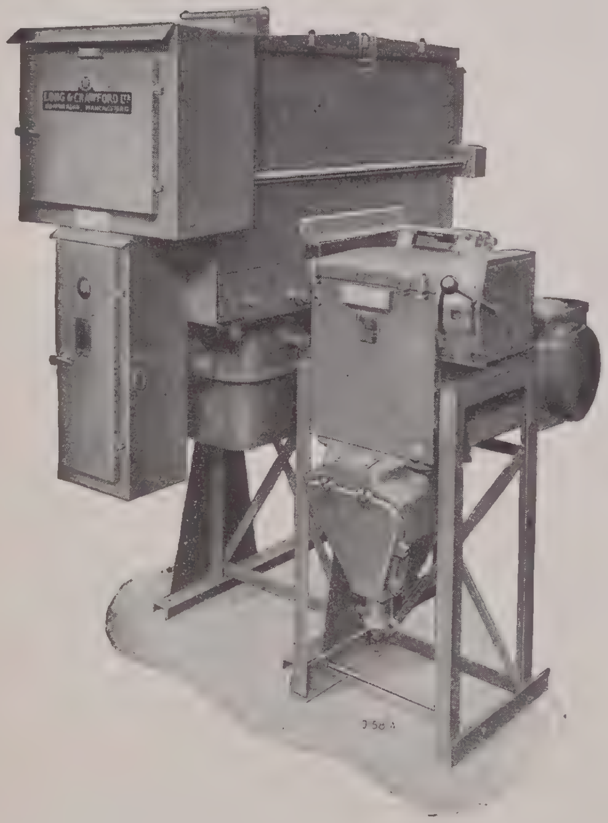

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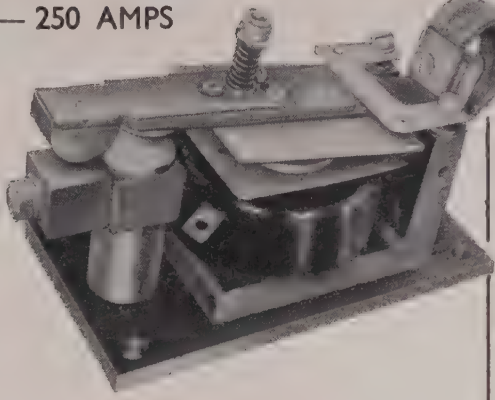

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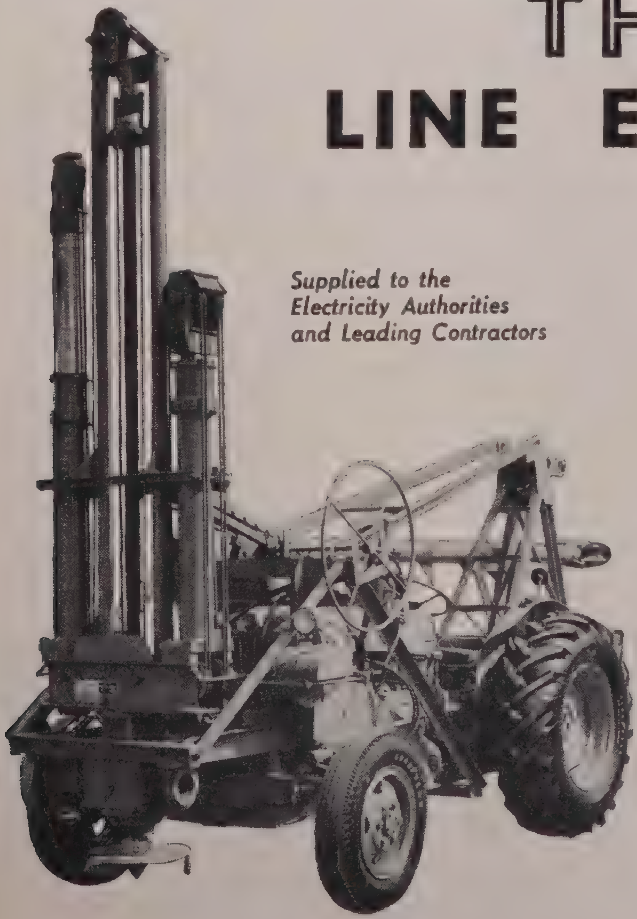

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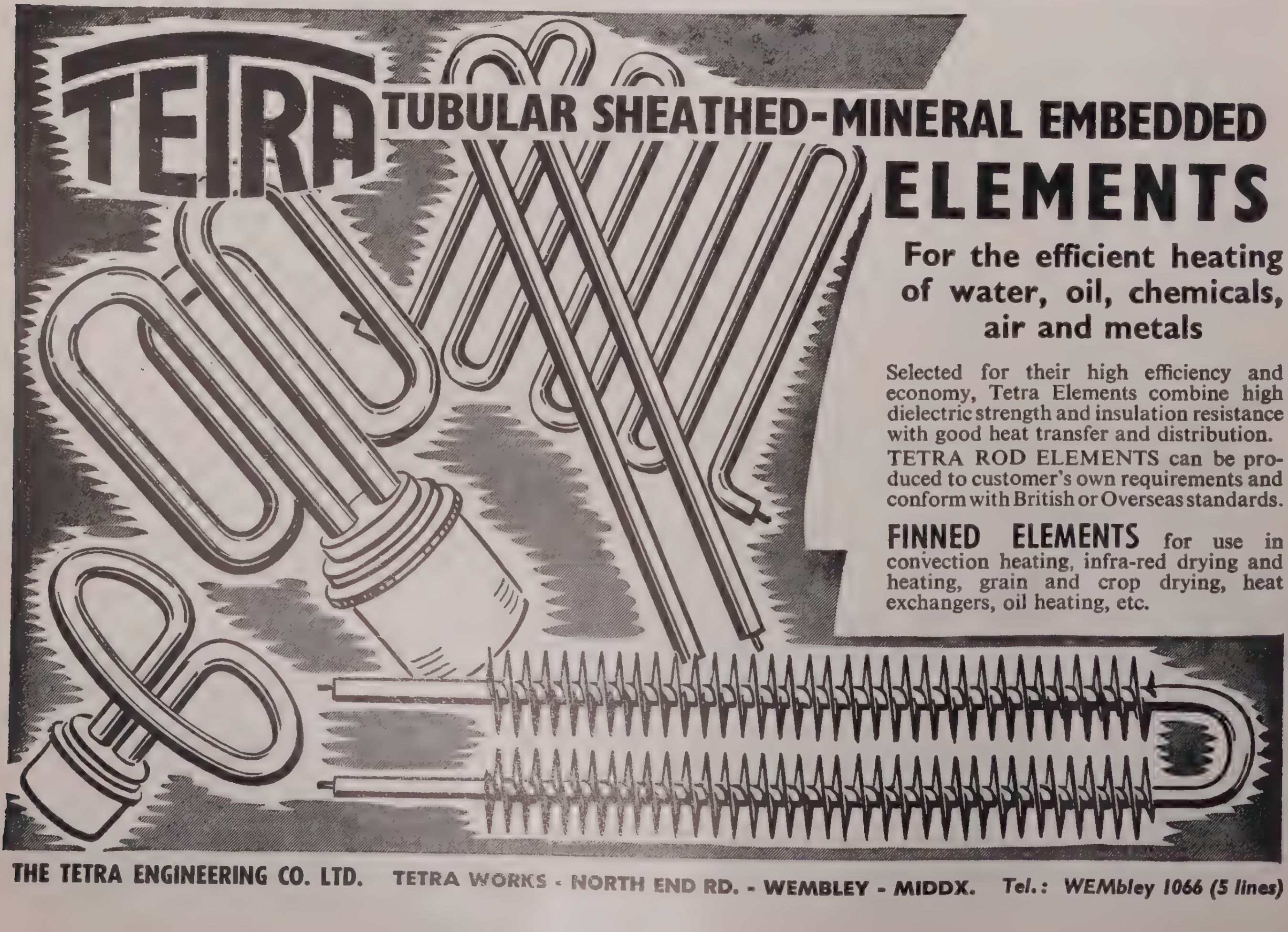

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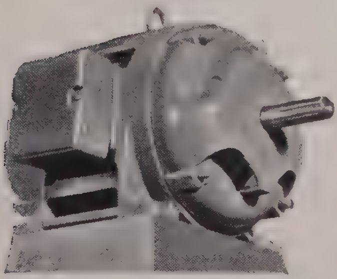

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TGA P4/1

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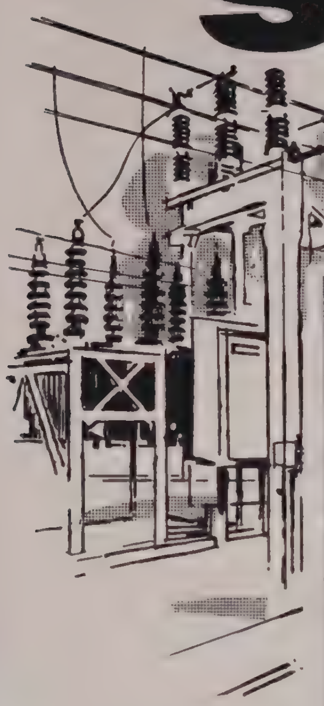
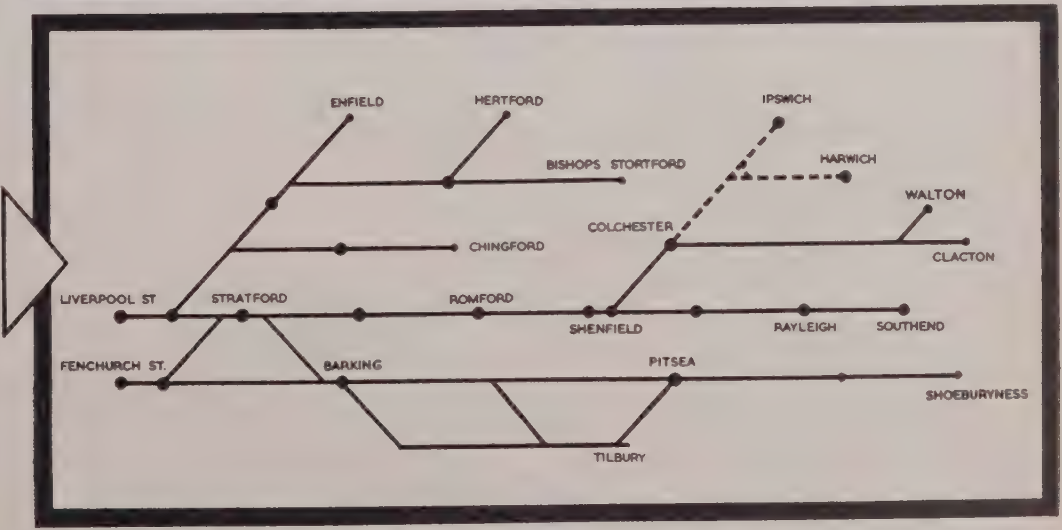
EASTERN REGION (BR) ELECTRIFICATION SCHEME



Romford Control Room.

The map shows the routes concerned, and the control stations at Romford and Pitsea serving the Liverpool Street and Fenchurch Street schemes respectively. When the schemes are completed, approximately 45 remote stations will be controlled from Romford and 14 from Pitsea.



This system is described in Publication No. R/132 available on request.

STC, foremost among manufacturers of Supervisory Remote Control and Indication Systems, are now engaged in the installation of equipment to provide remote supervision of the feeder stations and track sectioning cabins on the routes out of Liverpool Street which are shortly to be electrified at 6·25kv and 25kv. Equipment is also in course of manufacture for the similar electrification scheme for the Fenchurch Street routes. The equipment employs the latest techniques in transistorised frequency-modulated signalling and incorporates special safeguards to prevent any incorrect operations. The control panels are of the 1″ mosaic tile type, and control and indication devices have been specially devoloped to meet the B.T.C.'s requirements.

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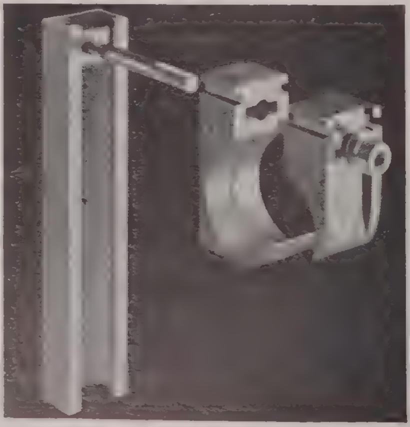

An exploded view of the C.S. system showing the principal components. The backnut at the channel end is self-locking.

C.E.G.B.'s Skelton Grange 'B' Power Station, Leeds.
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Publication No. 28

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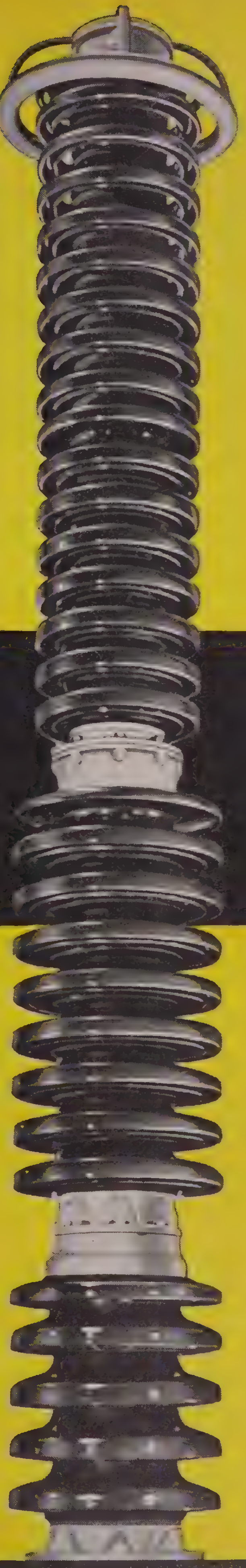
Multicone
Post Insulator



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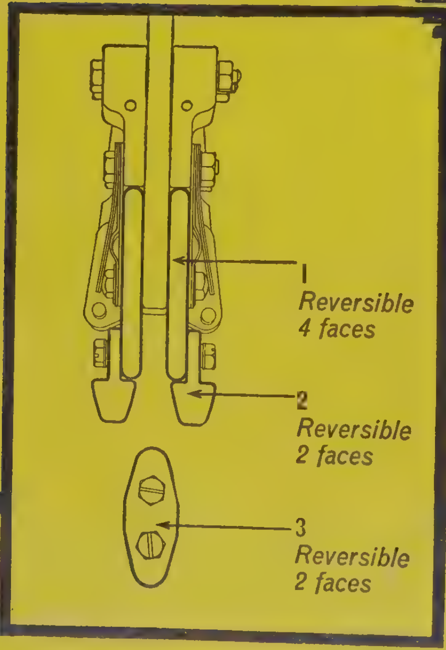

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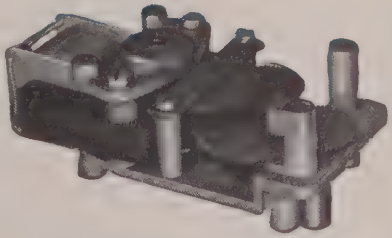

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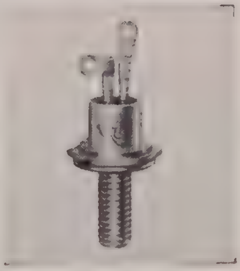

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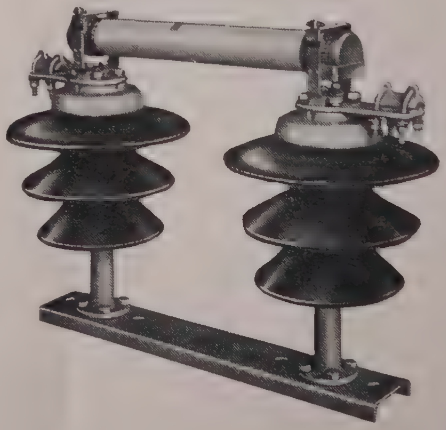

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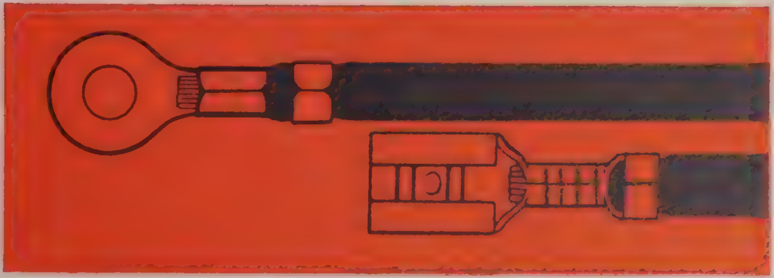

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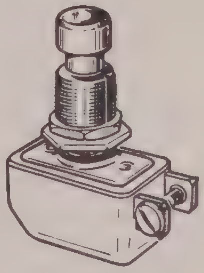

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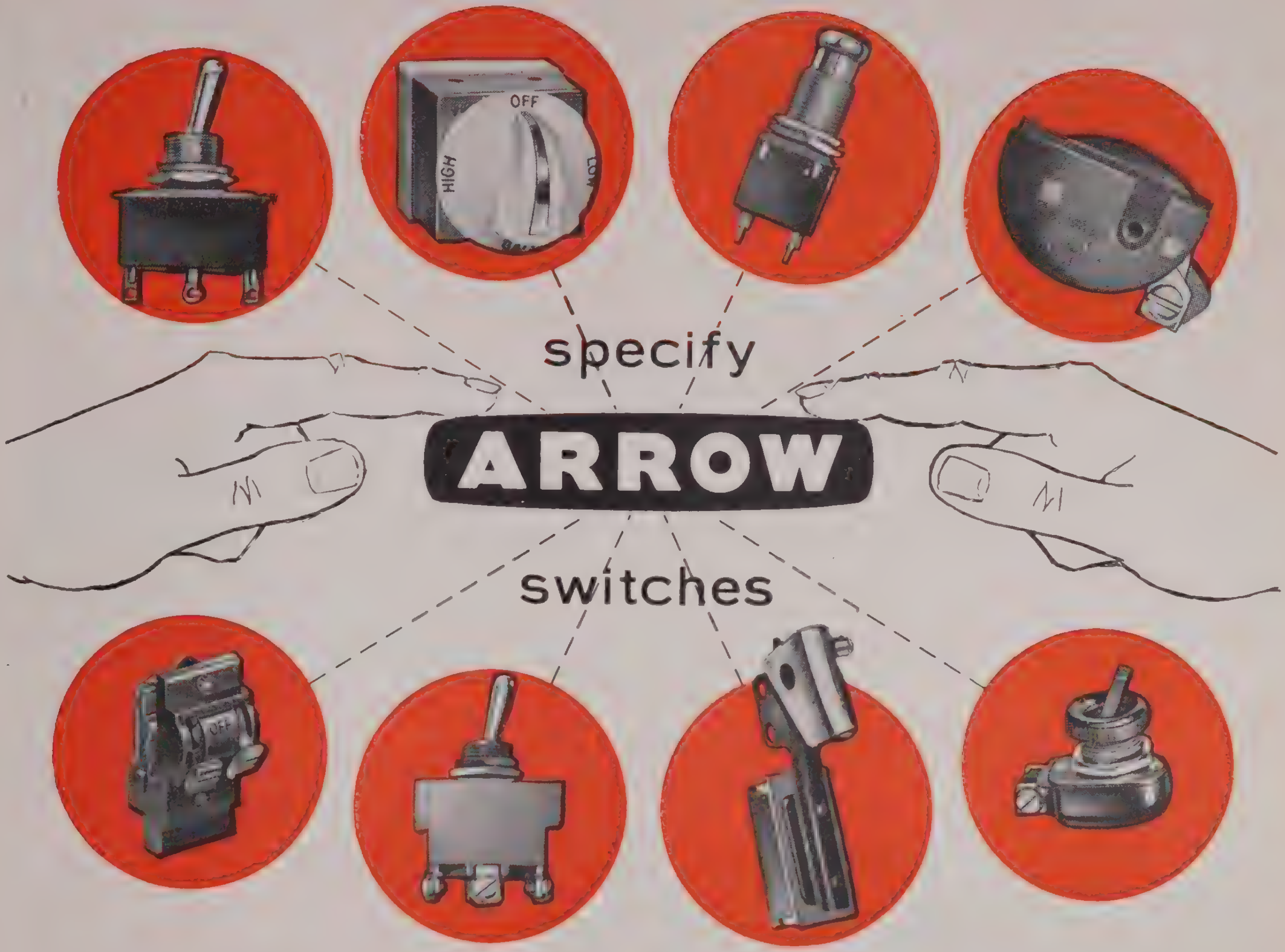

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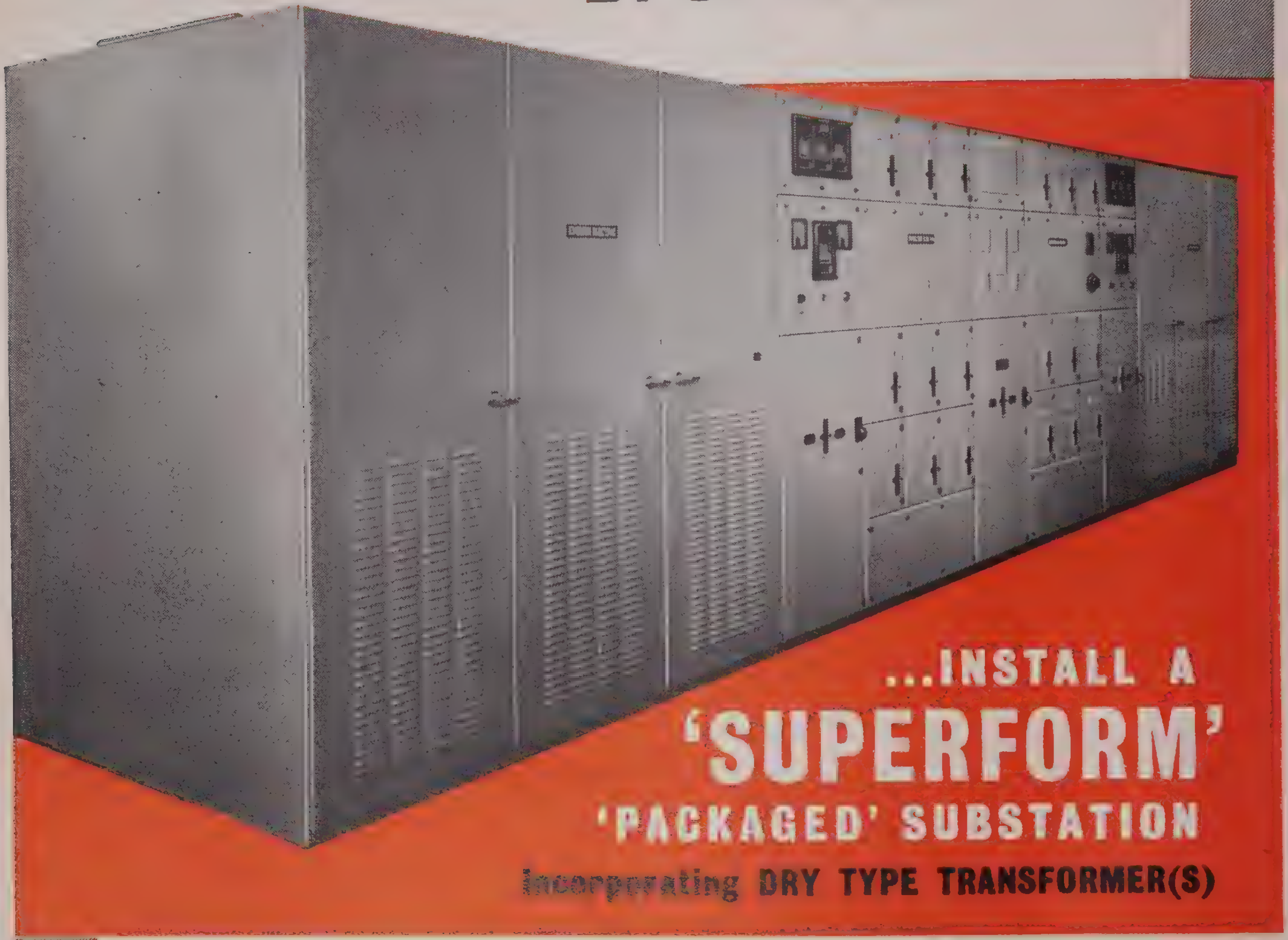

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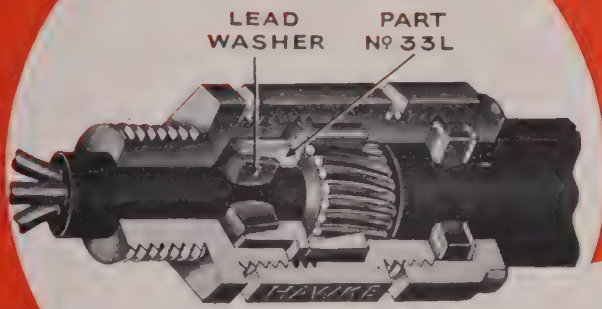

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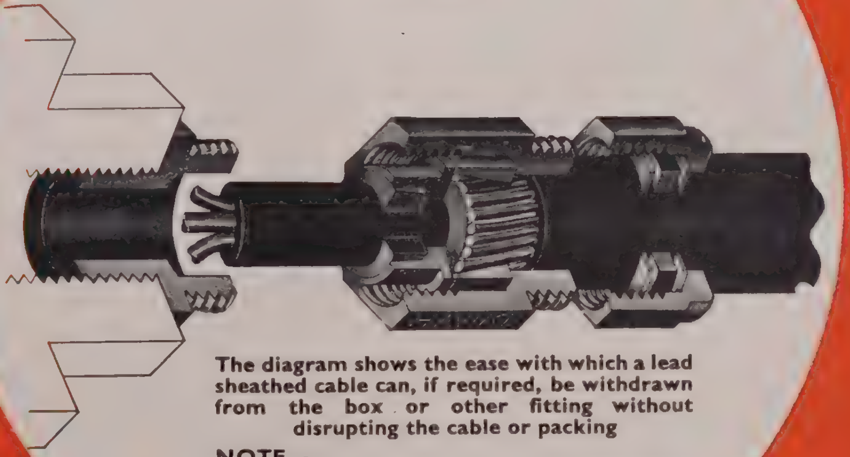

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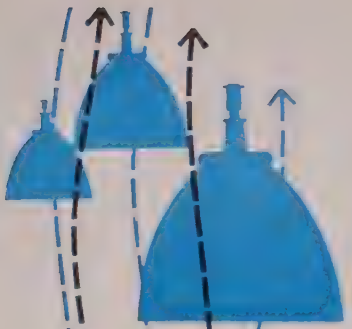

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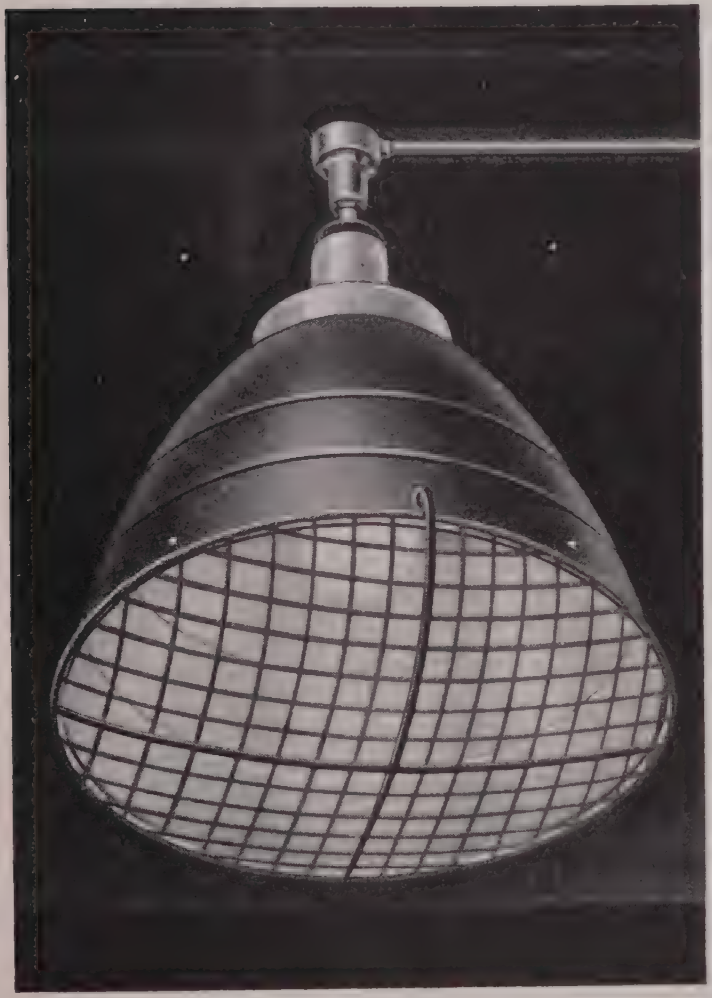

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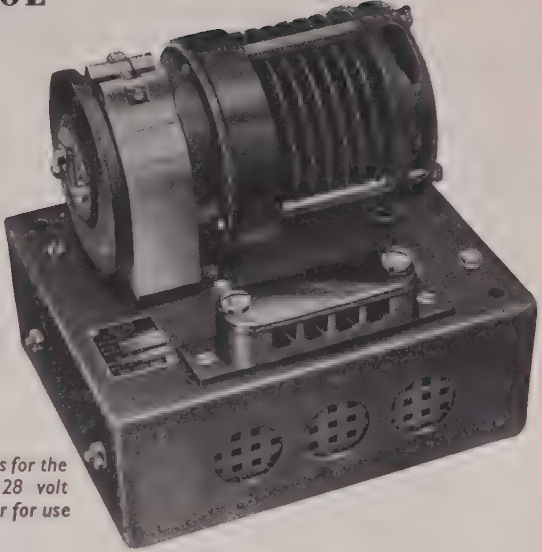

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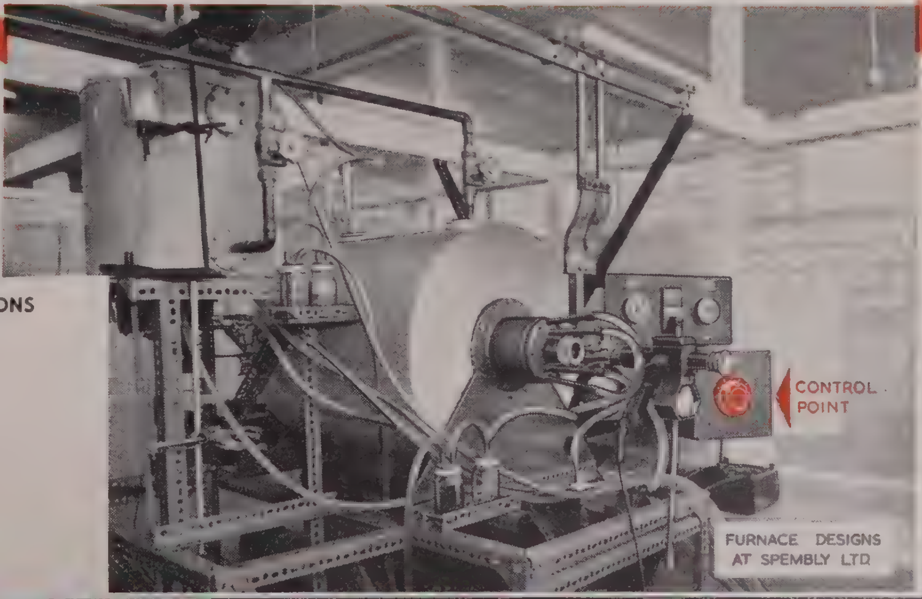

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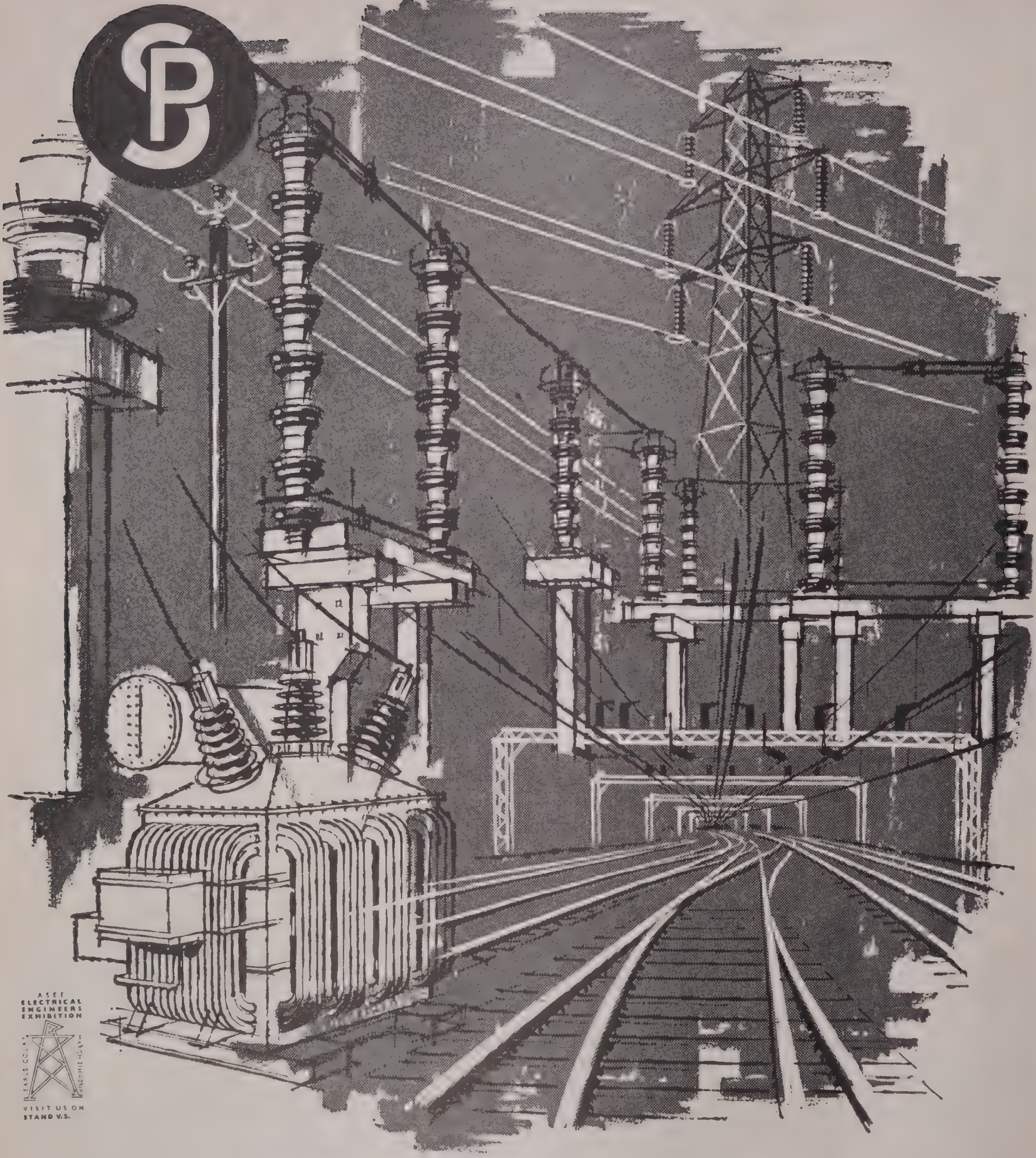

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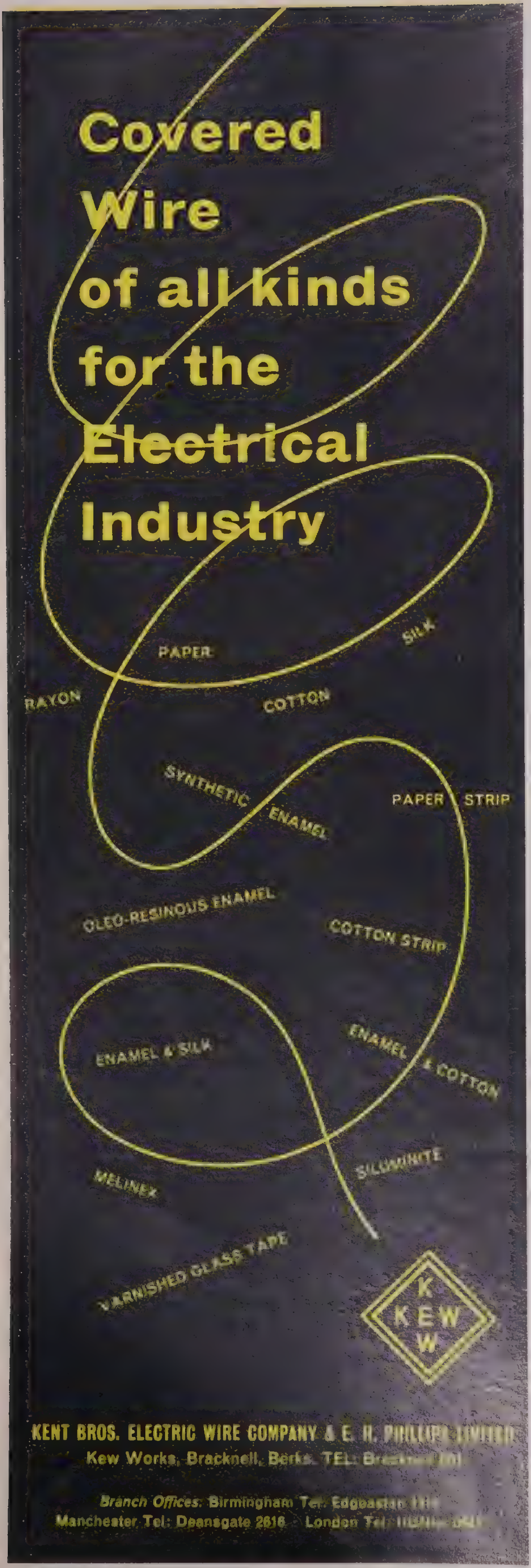

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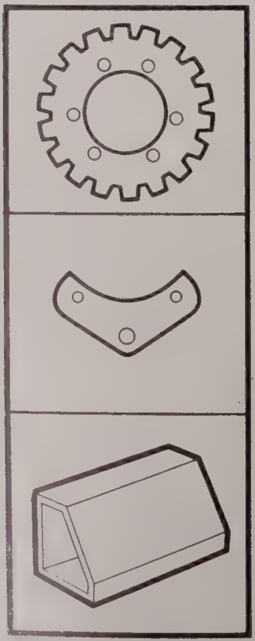

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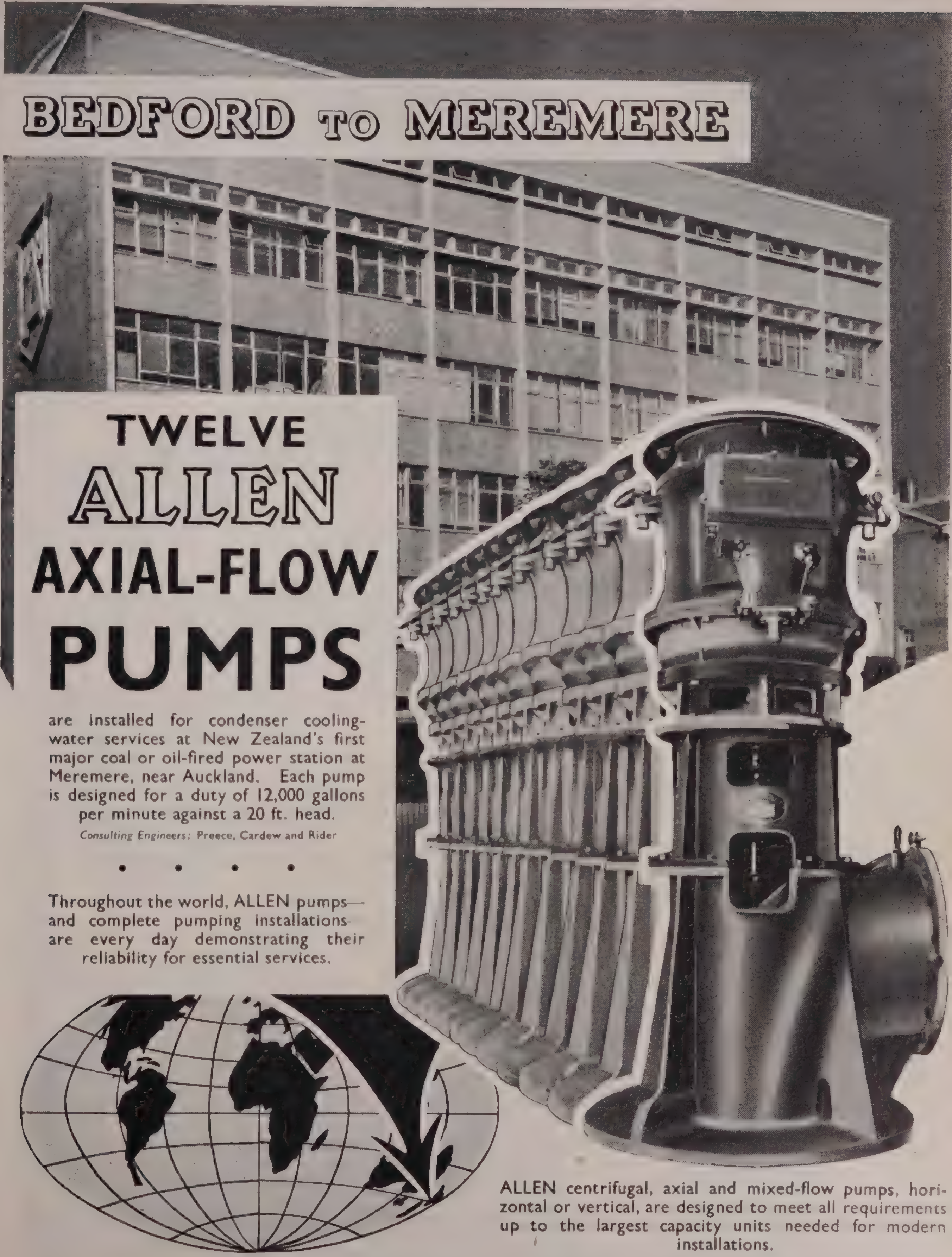

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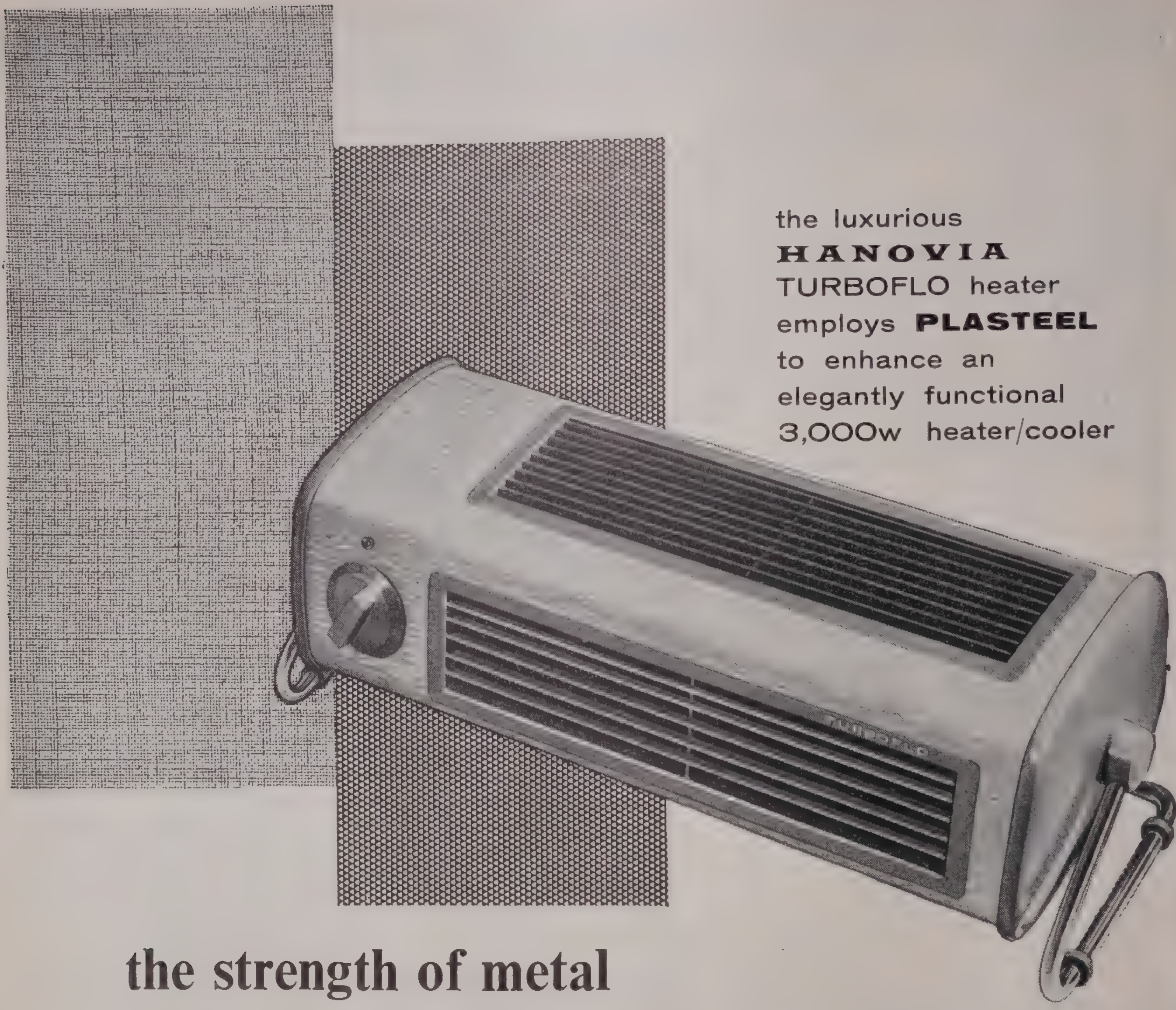

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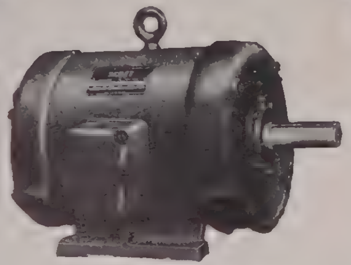

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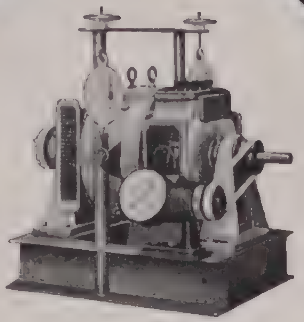

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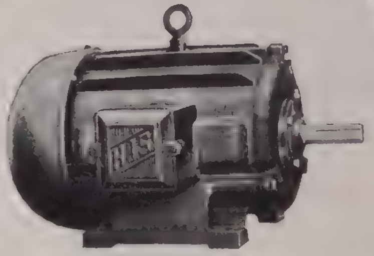

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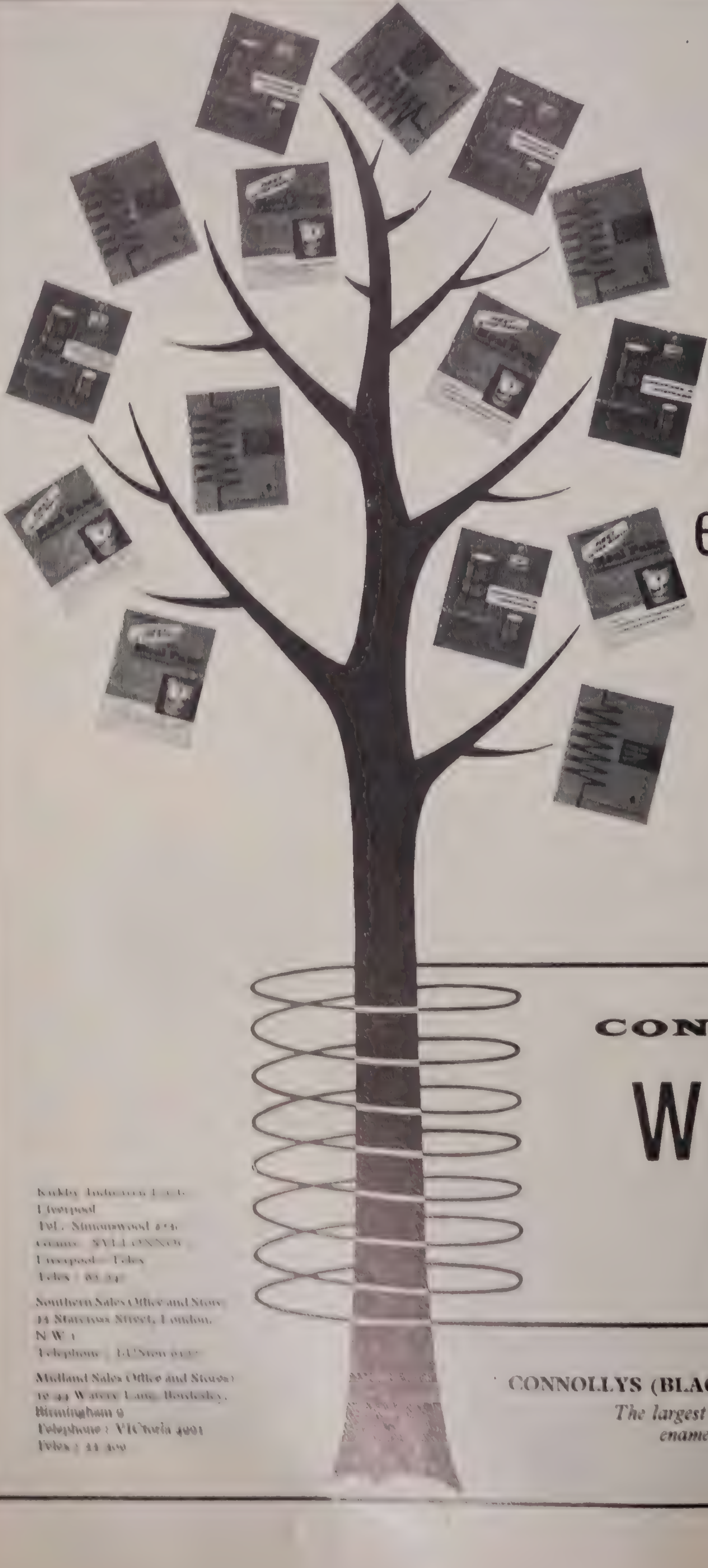

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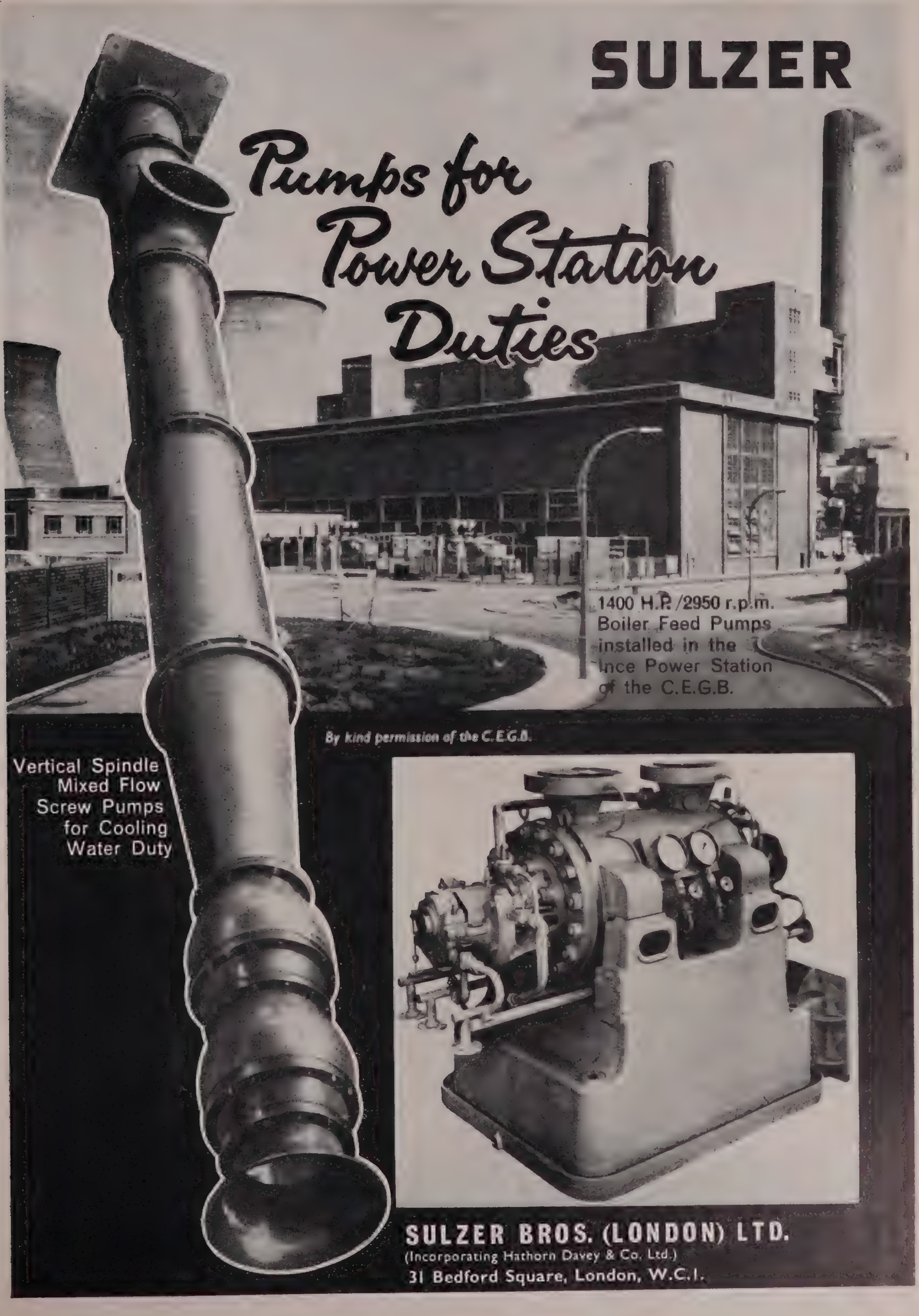

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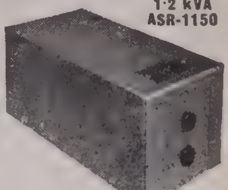

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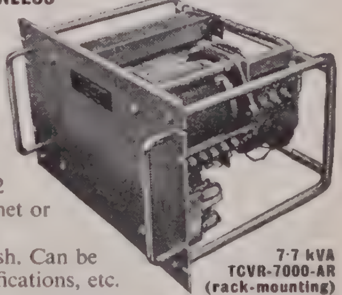

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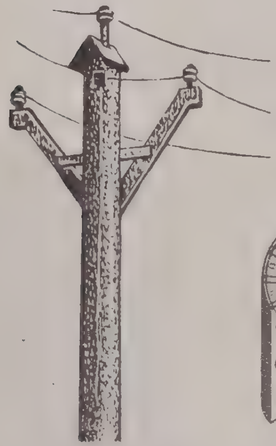
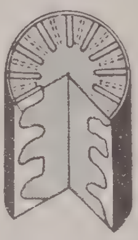


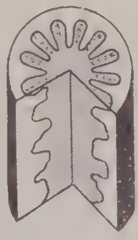
Note staggered placing of injections, made by means of thin tool steel needles which merely part the fibres—nothing is taken from the pole and strength is maintained.

poles last 15-20 years longer with COBRA

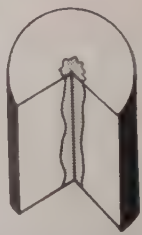
☐ Unprotected wood
☐ Cobra salts
■ Coal tar seal



Preservative spreading outward from all the concentrated deposits, giving complete penetration of the sapwood.



Intermingling diffusion of the SALTS from all injection planes and continued penetration into the heartwood



Continued penetration to the heart with SALTS adhering to wood cells as a *stable protection.*

The detection and treatment of decay and rot, to be economically effective, requires specialist knowledge and attention. Cobra experts inspect and report, in detail, on each pole individually. All equipment, operators and transport are provided by the Cobra service. Cobra treatment is carried out without interruption to the normal operation of the overhead lines.

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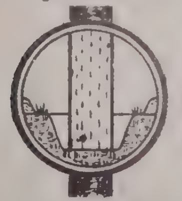

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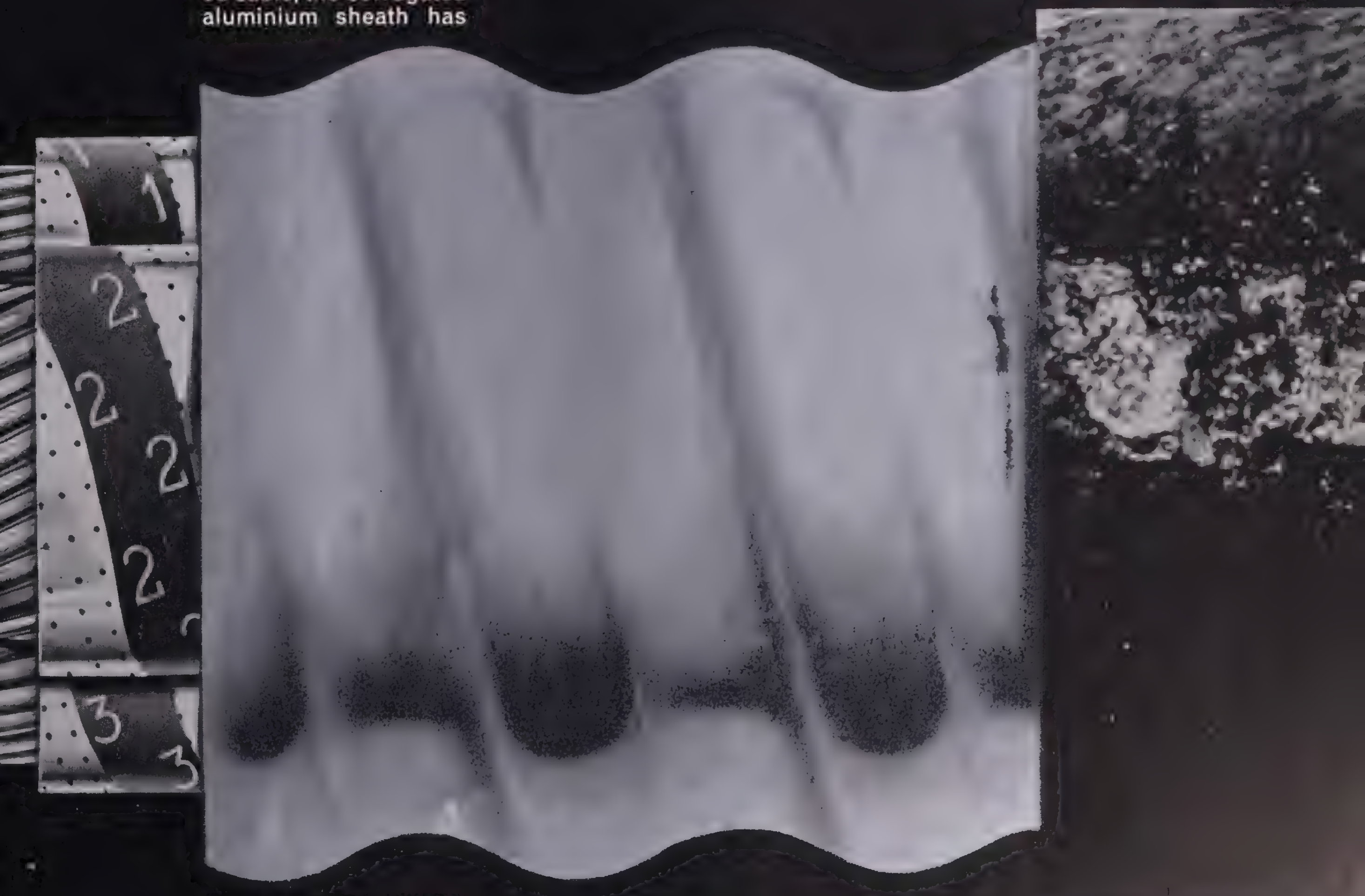

equal flexibility, and the sinusoidal form of the corrugation ensures uniform distribution of the bending stresses. During the past five years many successful installations have been carried out both in this country and overseas.

PIRELLI GENERAL
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Driving a single earthing rod into the soil doesn't necessarily mean that you have a good earth! First, you must be sure that your connection has a low resistance to earth — the measure of electrical effectiveness. The safest way is to use an earth testing meter. If the resistance is high you need additional rods, spaced from the first, and connected in multiple — or better yet, use the new deep earthing method. Tremendous improvements in earth resistance have been obtained with Copperweld Sectional Rods driven to depths of 20, 30, 40 feet or more. These rods penetrate low-resistance soils, where the moisture is permanent. Thus, you have a dependable earth the year 'round. To be really sure, use Copperweld, for then you know that the earth rod will not have rusted out when you need it, and that you always have dependable copper-to-copper connections.

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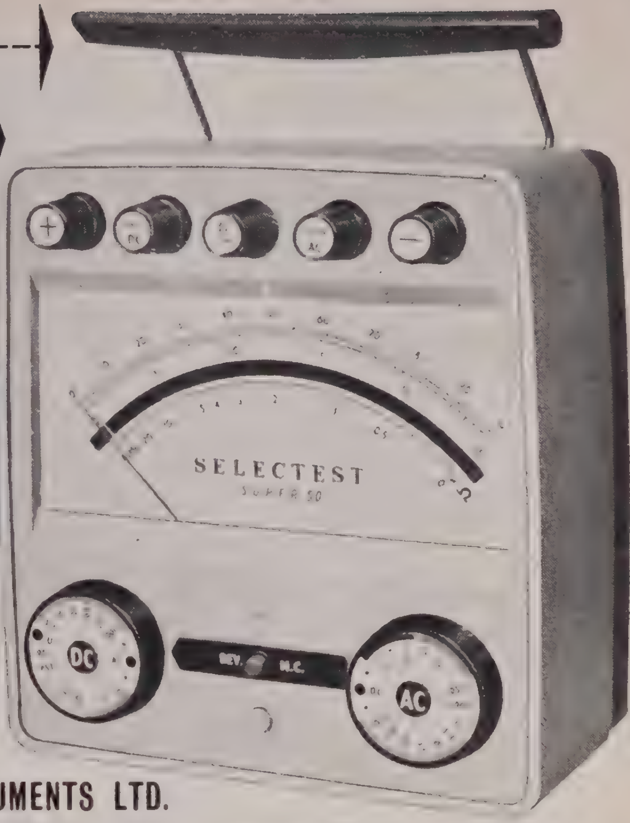

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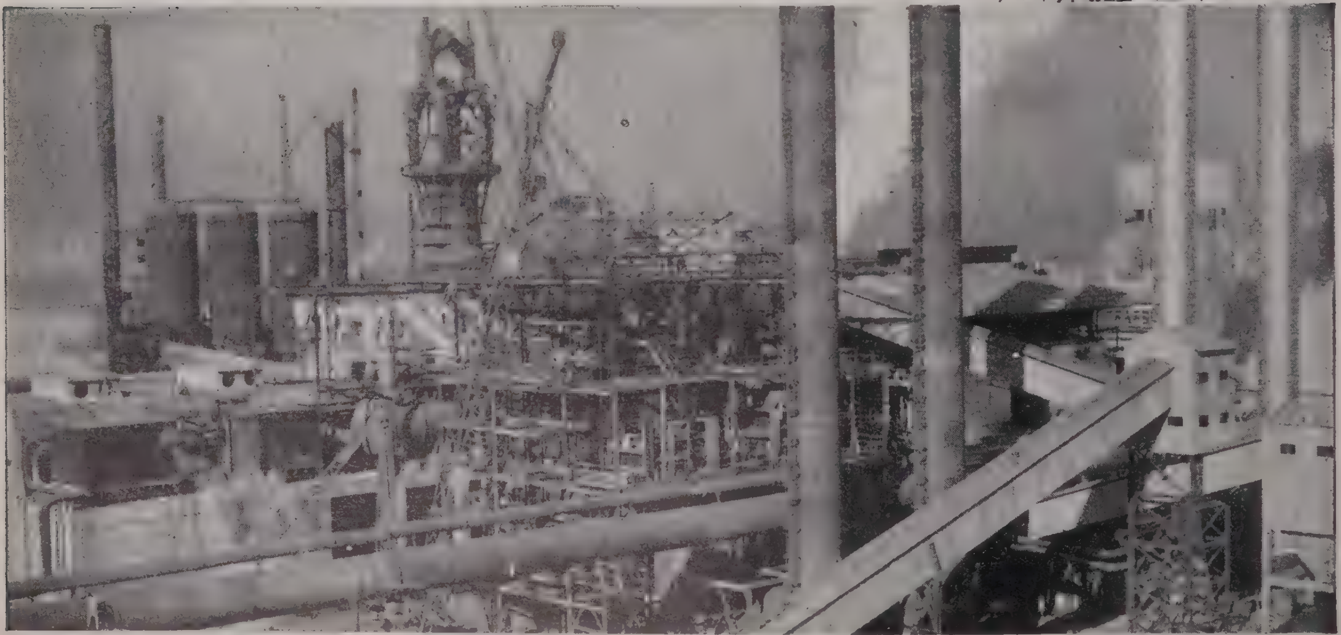

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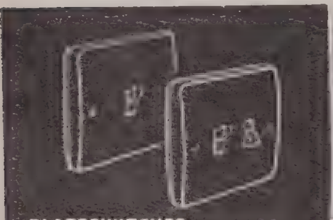

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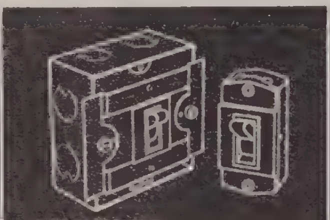

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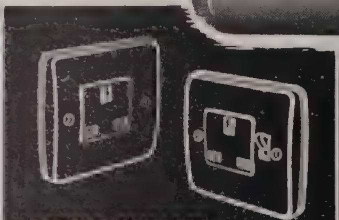

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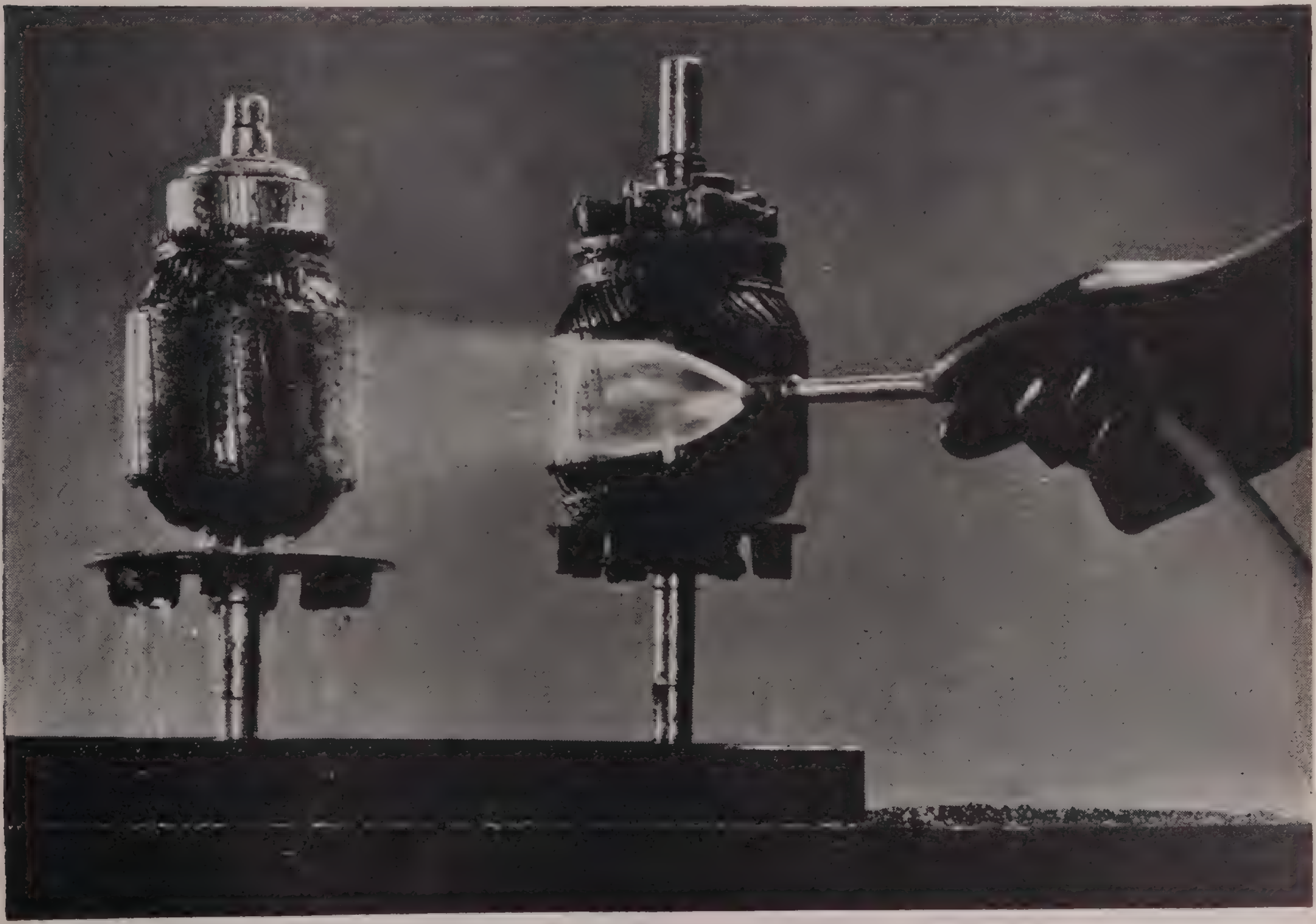

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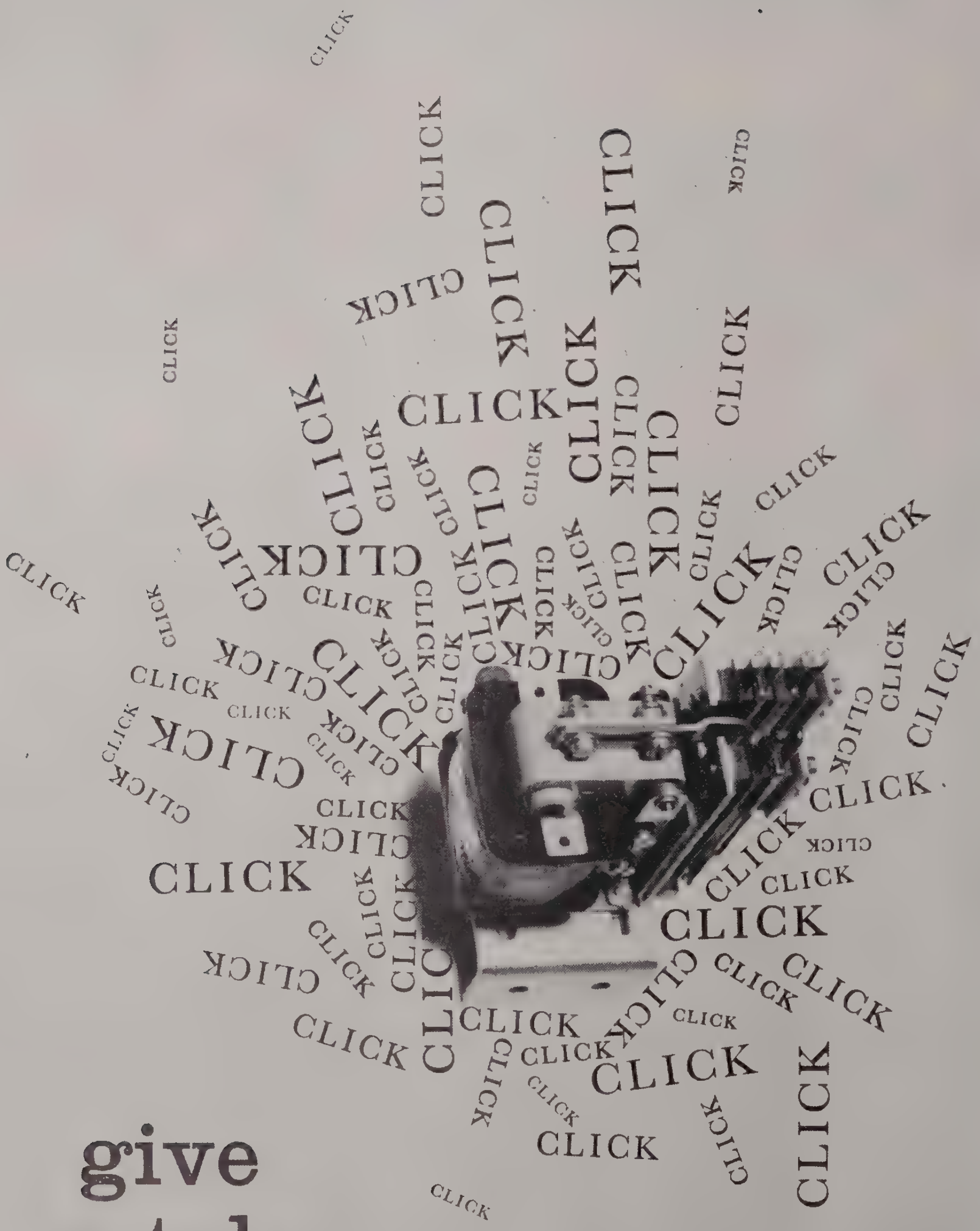

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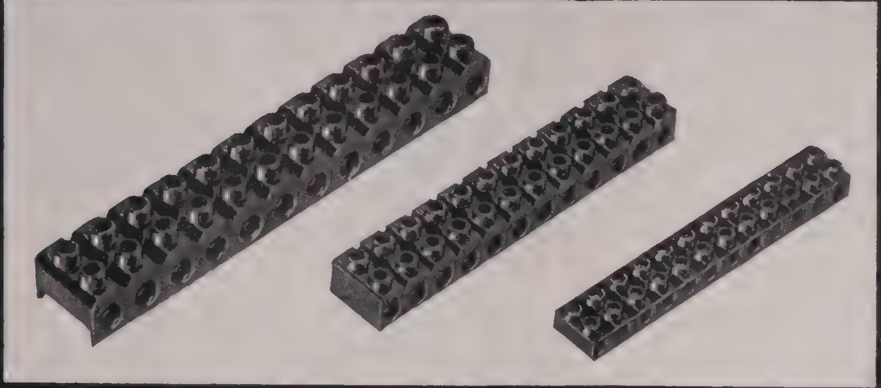

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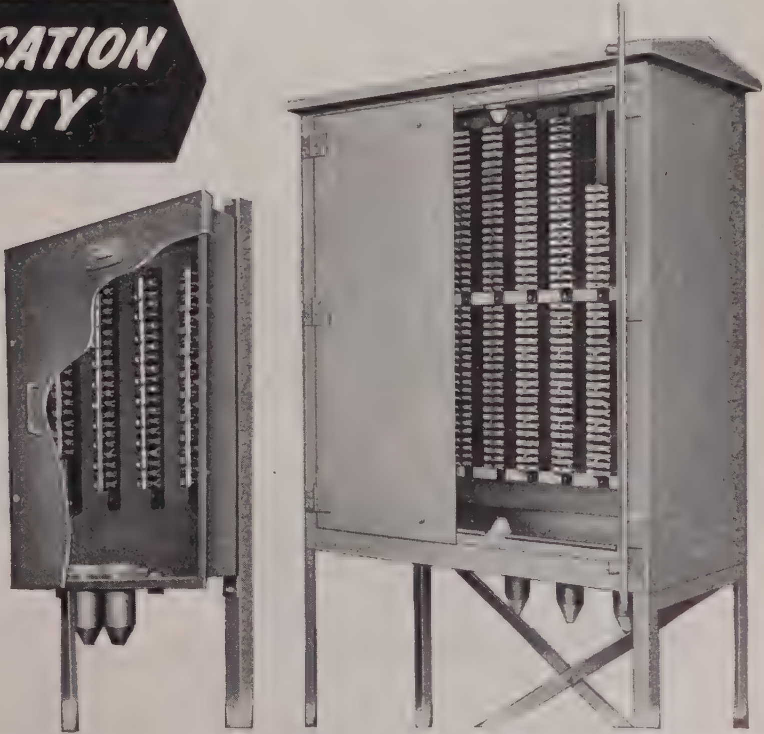

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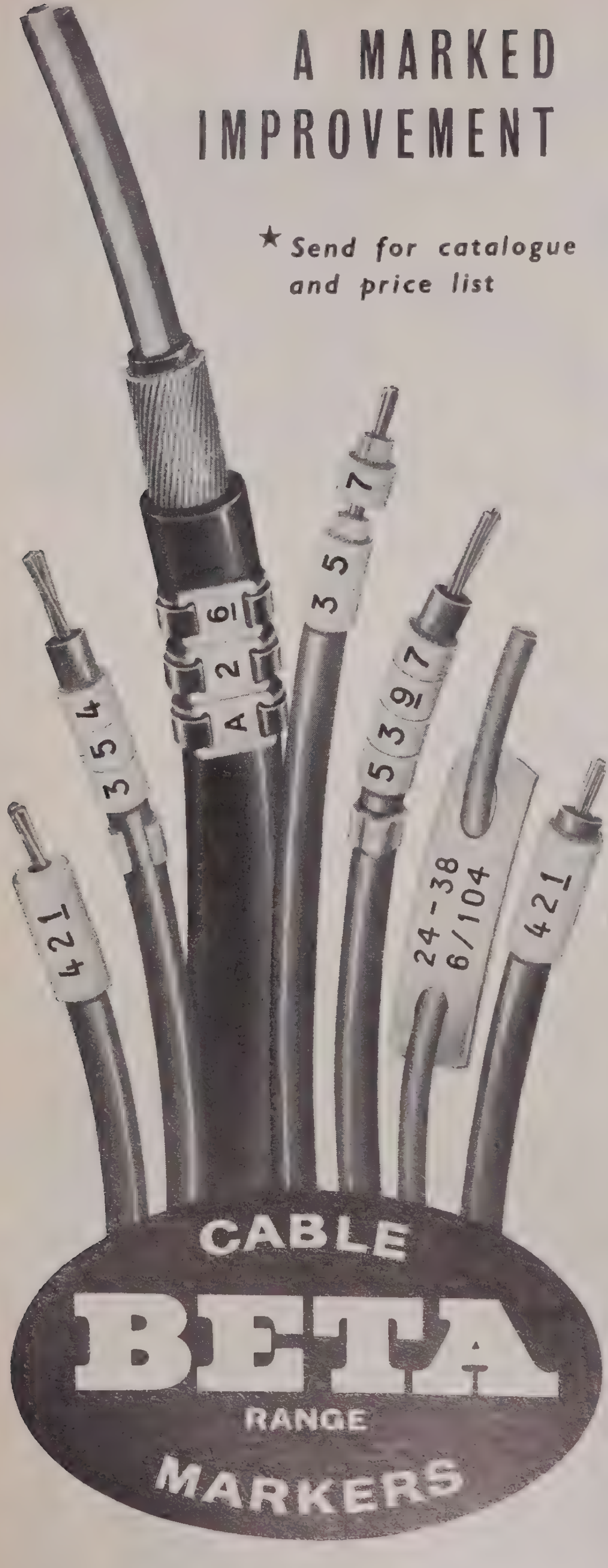

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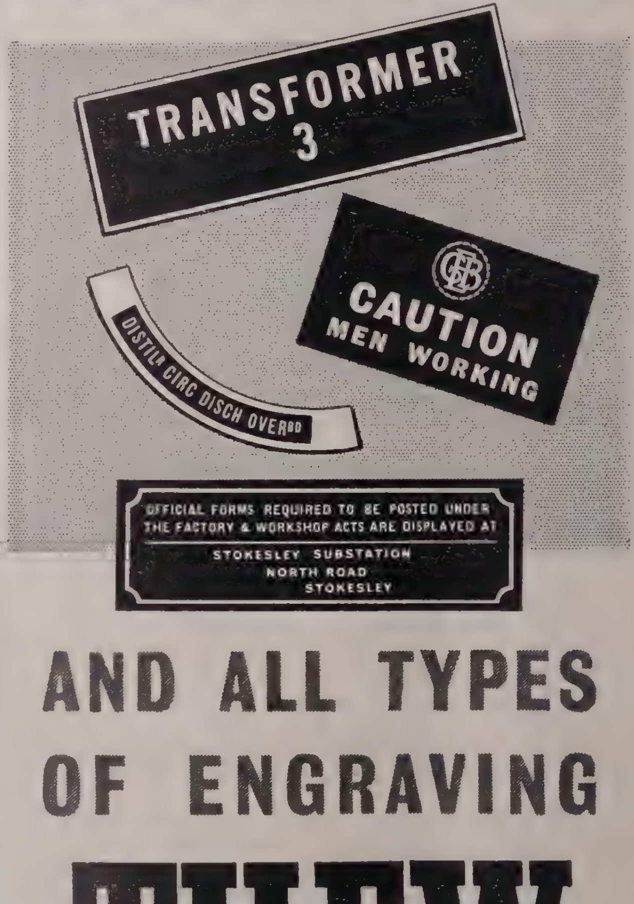
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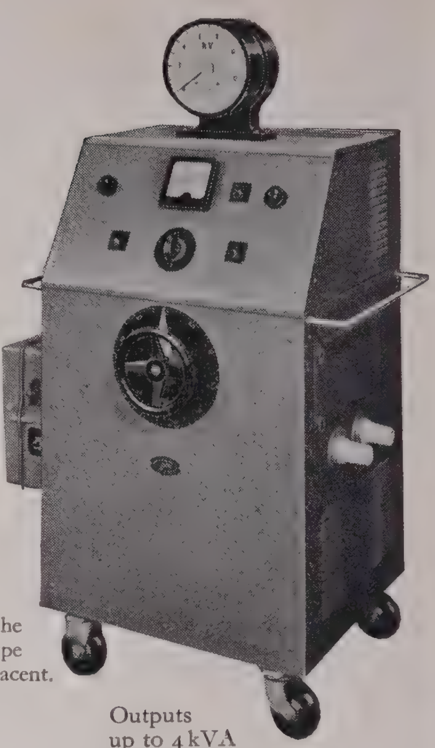

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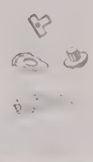

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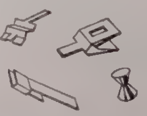

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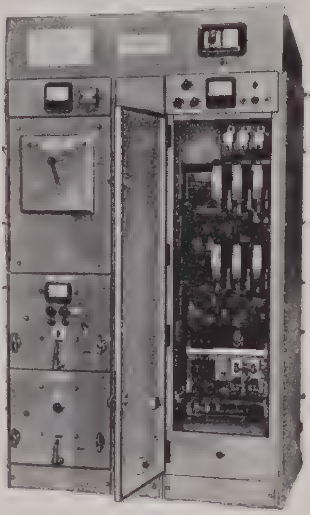

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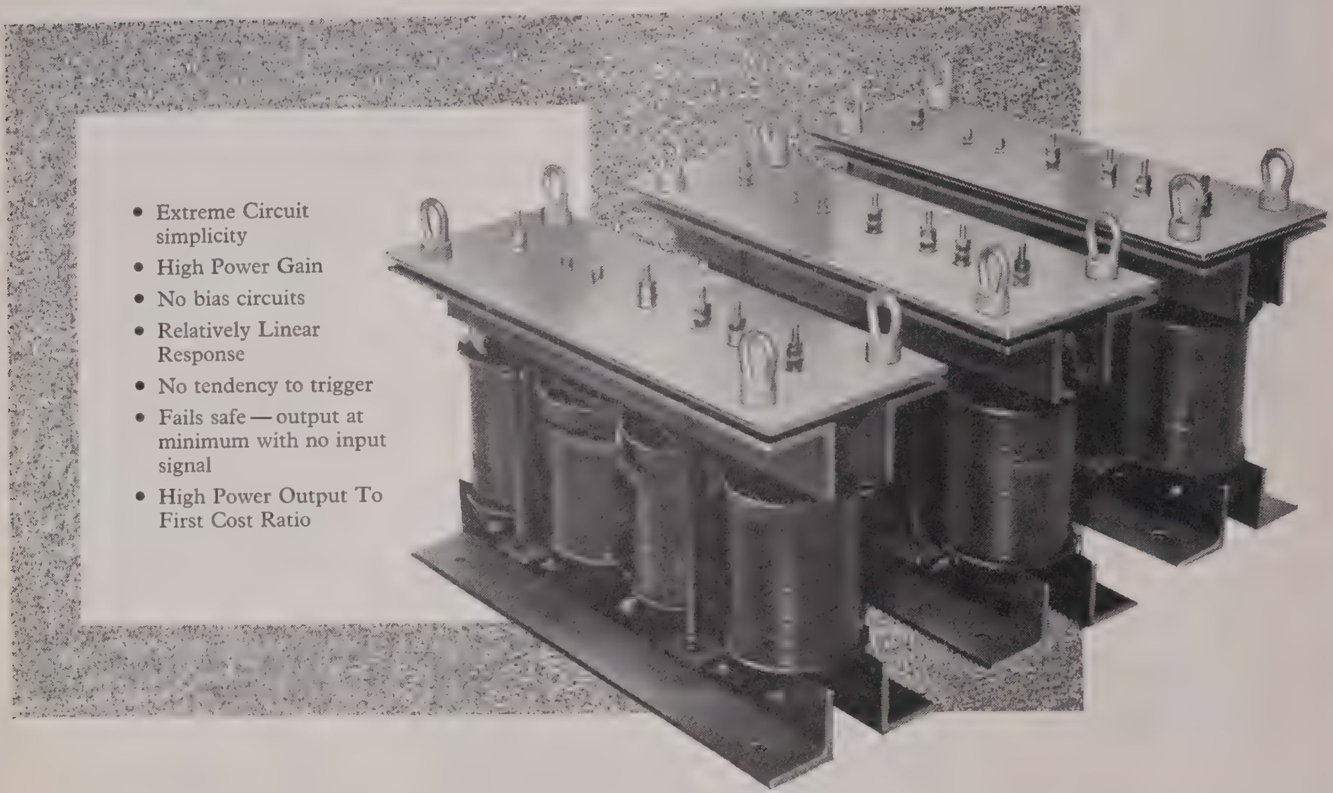

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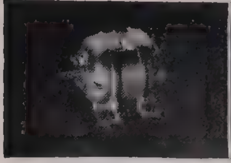
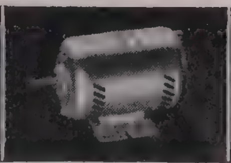
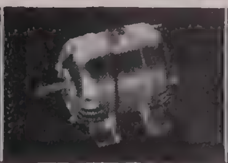
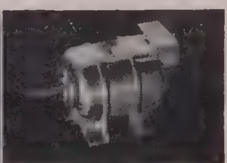

Shaded Pole
Constant
Speed
1/300-1/140 HP

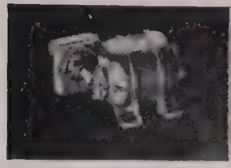
Series Wound
Variable
Speed
1/100-1/10 HP


Series Wound
Variable
Speed
1/40-1/5 HP


Capacitor
Constant
Speed
1/150-1/30 HP

Capacitor
Constant
Speed
1/40-1/5 HP


Split Phase
Constant
Speed
1/40-1/5 HP


Shaded Pole
Constant
Speed
19-330 RPM

Series Wound
Variable
Speed
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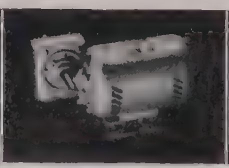
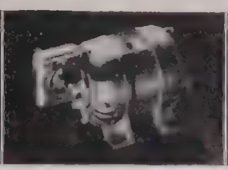
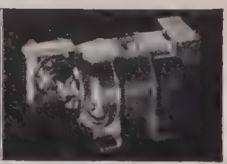
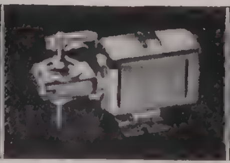

Series Wound
Variable
Speed
22-800 RPM

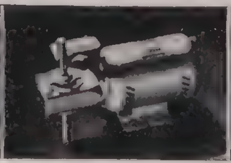

Capacitor
Constant
Speed
17-680 RPM

Capacitor
Constant
Speed
20-700 RPM


Split Phase
Constant
Speed
20-700 RPM

Shaded Pole
Constant
Speed
1/4-18 RPM


Series Wound
Variable
Speed
0·5-60 RPM


Series Wound
Variable
Speed
0·3-60 RPM

Capacitor
Constant
Speed
0·3-19·5 RPM

Capacitor
Constant
Speed
0·2-19 RPM

Split Phase
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Speed
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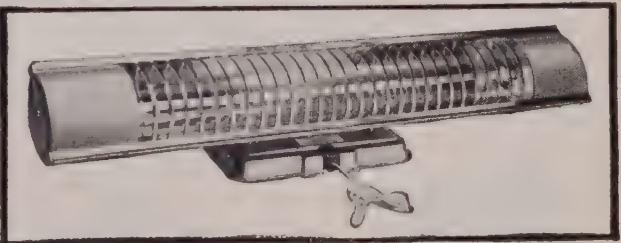

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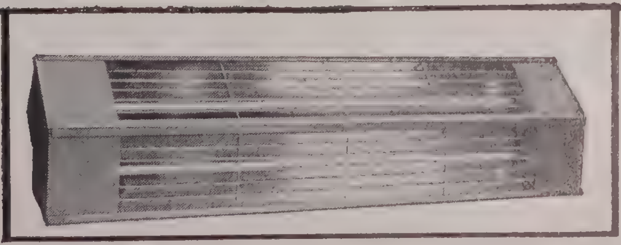

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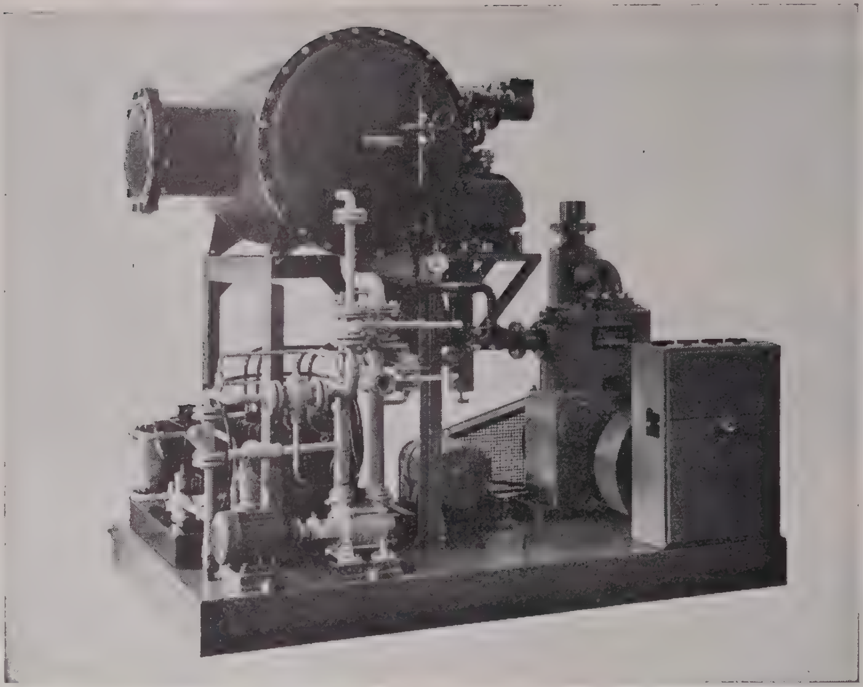

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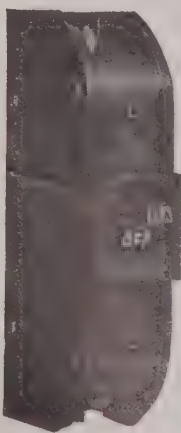

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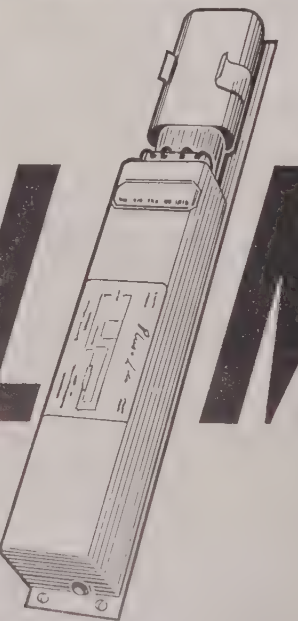

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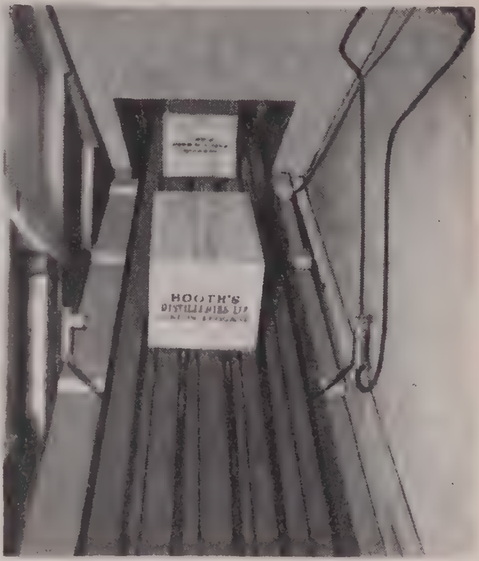

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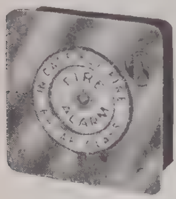

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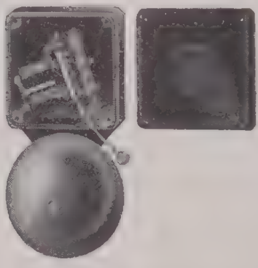

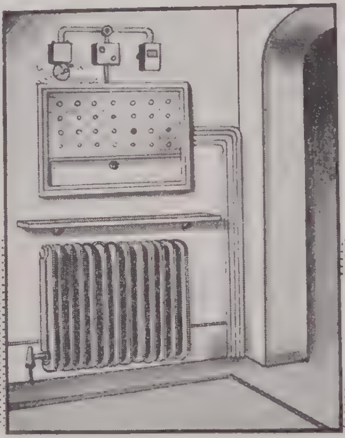

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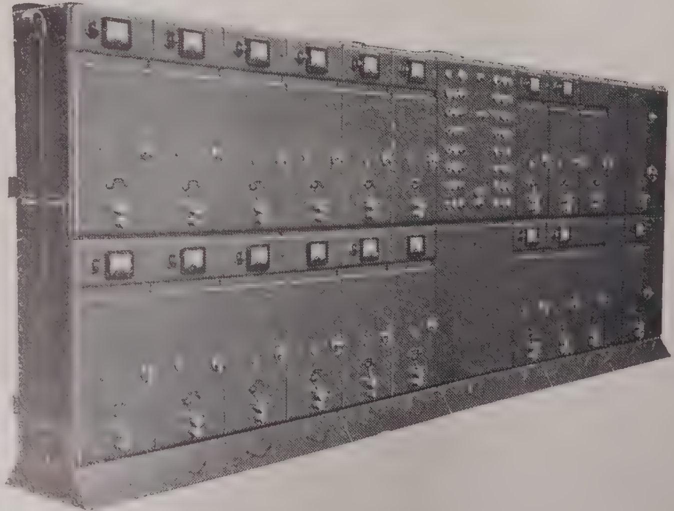

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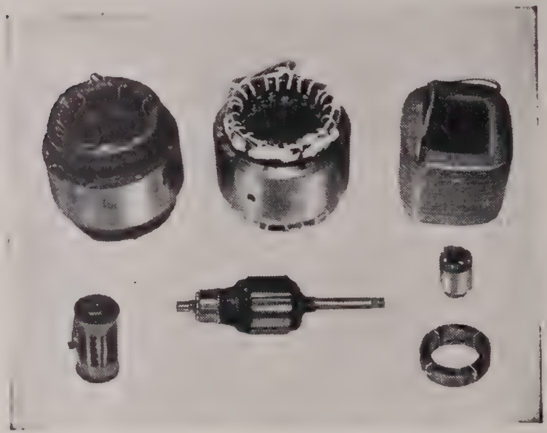

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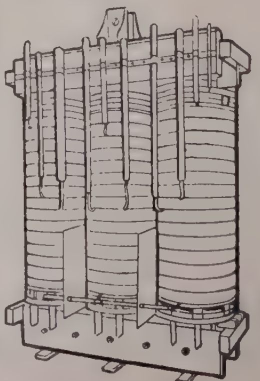

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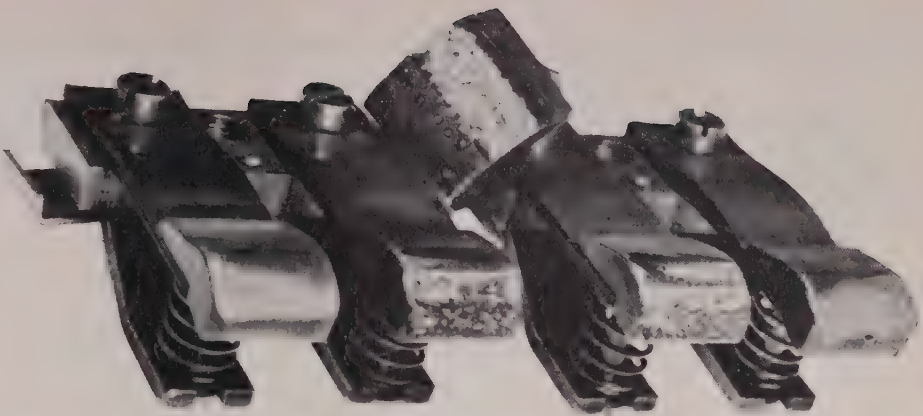
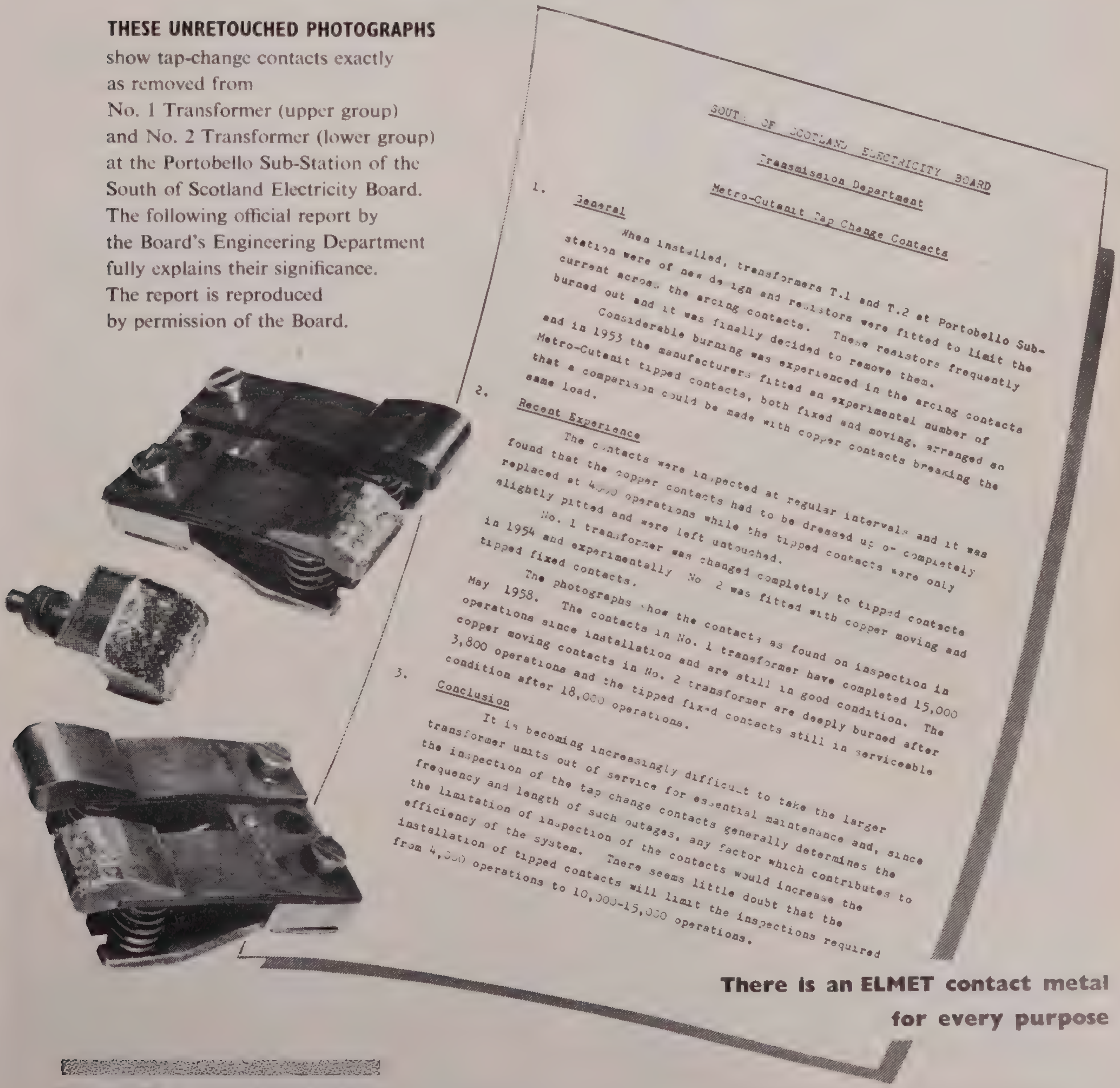


ELMET facings increased transformer tap change contact inspection intervals by 250 to 375 per cent

THESE UNRETOUCHED PHOTOGRAPHS show tap-change contacts exactly as removed from No. 1 Transformer (upper group) and No. 2 Transformer (lower group) at the Portobello Sub-Station of the South of Scotland Electricity Board. The following official report by the Board's Engineering Department fully explains their significance. The report is reproduced by permission of the Board.



SOUTH OF SCOTLAND ELECTRICITY BOARD

Transmission Department

Metro-Cutanit Tap Change Contacts

1. General

When installed, transformers T.1 and T.2 at Portobello Sub-station were of new design and resistors were fitted to limit the current across the arcing contacts. These resistors frequently burned out and it was finally decided to remove them.

Considerable burning was experienced in the arcing contacts and in 1953 the manufacturers fitted an experimental number of Metro-Cutanit tipped contacts, both fixed and moving, arranged so that a comparison could be made with copper contacts breaking the same load.

2. Recent Experience

The contacts were inspected at regular intervals and it was found that the copper contacts had to be dressed up or completely replaced at 4,000 operations while the tipped contacts were only slightly pitted and were left untouched.

No. 1 transformer was changed completely to tipped contacts in 1954 and experimentally No 2 was fitted with copper moving and tipped fixed contacts.

The photographs show the contacts as found on inspection in May 1958. The contacts in No. 1 transformer have completed 15,000 operations since installation and are still in good condition. The copper moving contacts in No. 2 transformer are deeply burned after 3,800 operations and the tipped fixed contacts still in serviceable condition after 18,000 operations.

3. Conclusion

It is becoming increasingly difficult to take the larger transformer units out of service for essential maintenance and, since the inspection of the tap change contacts generally determines the frequency and length of such outages, any factor which contributes to the limitation of inspection of the contacts would increase the efficiency of the system. There seems little doubt that the installation of tipped contacts will limit the inspections required from 4,000 operations to 10,000-15,000 operations.

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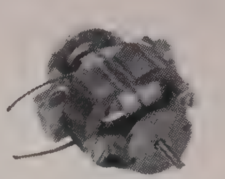

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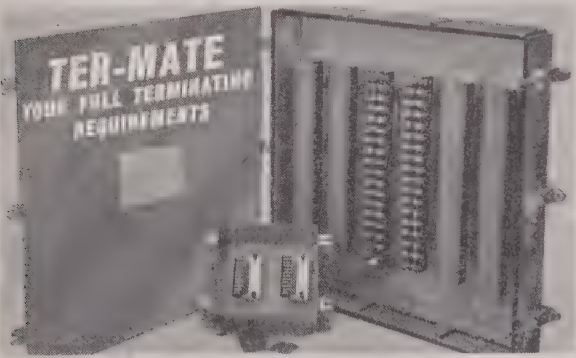

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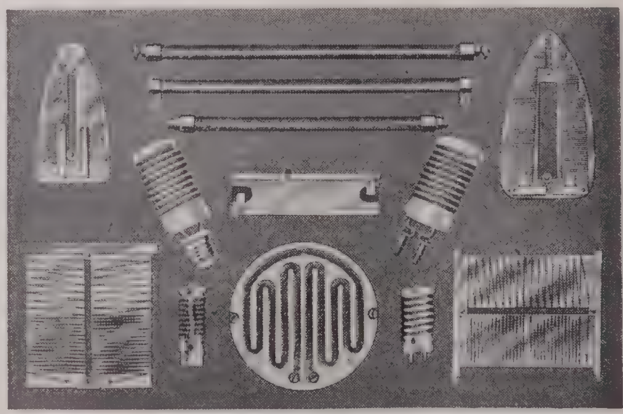

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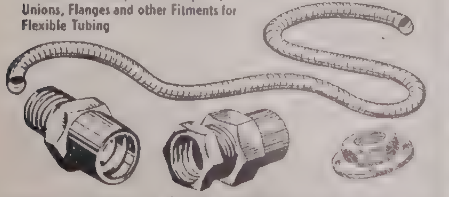

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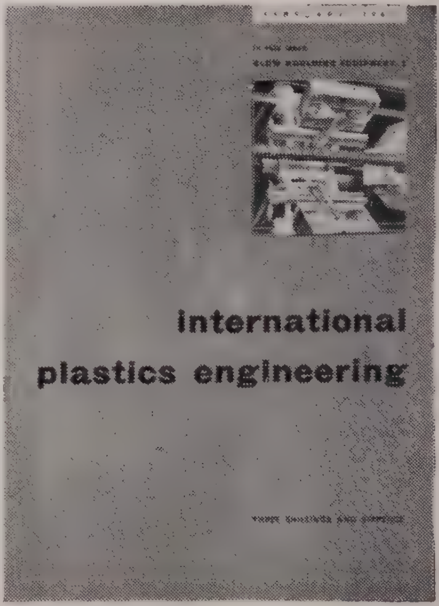

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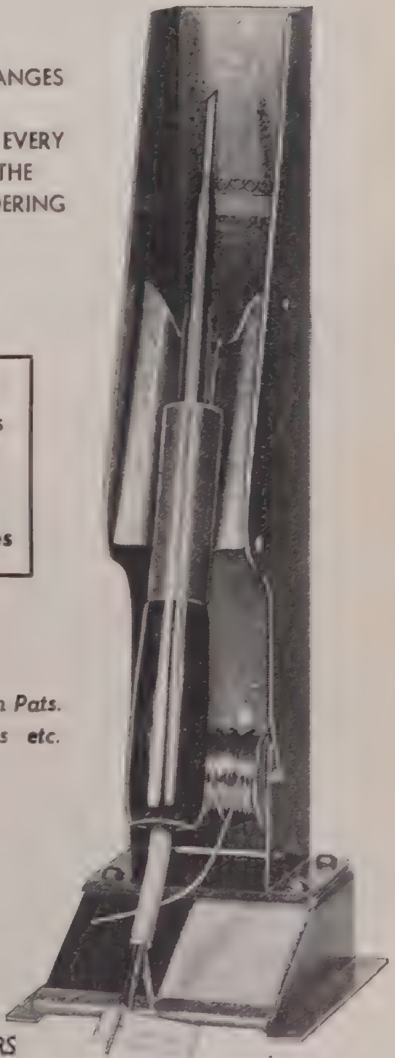

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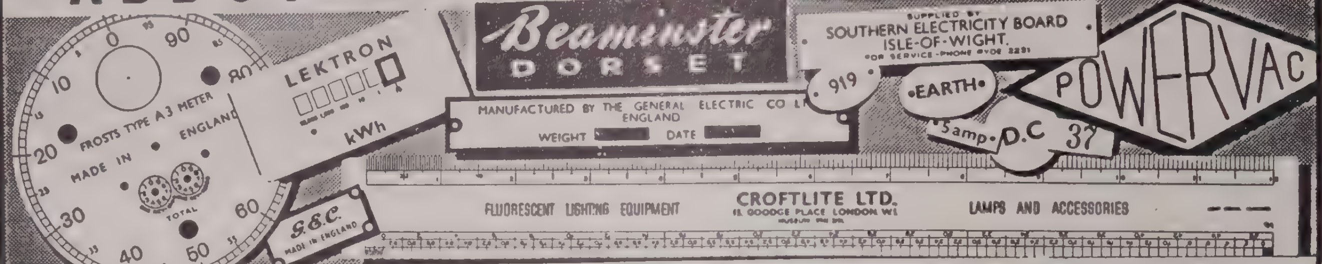

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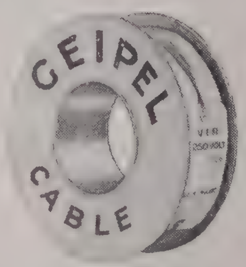

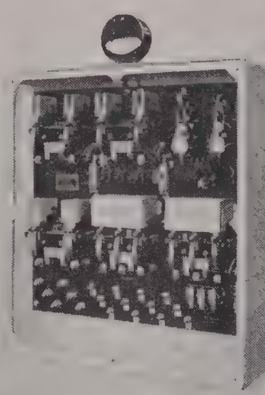

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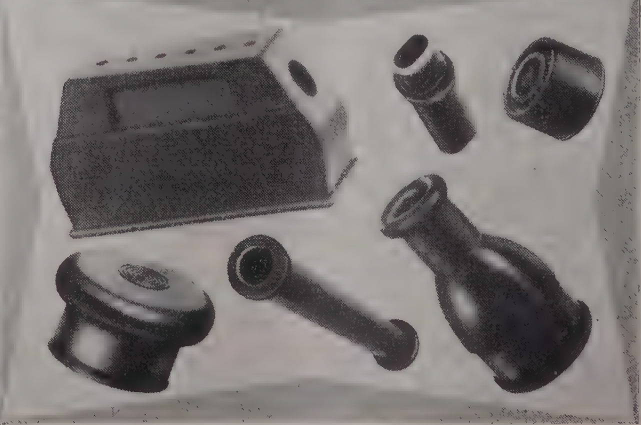

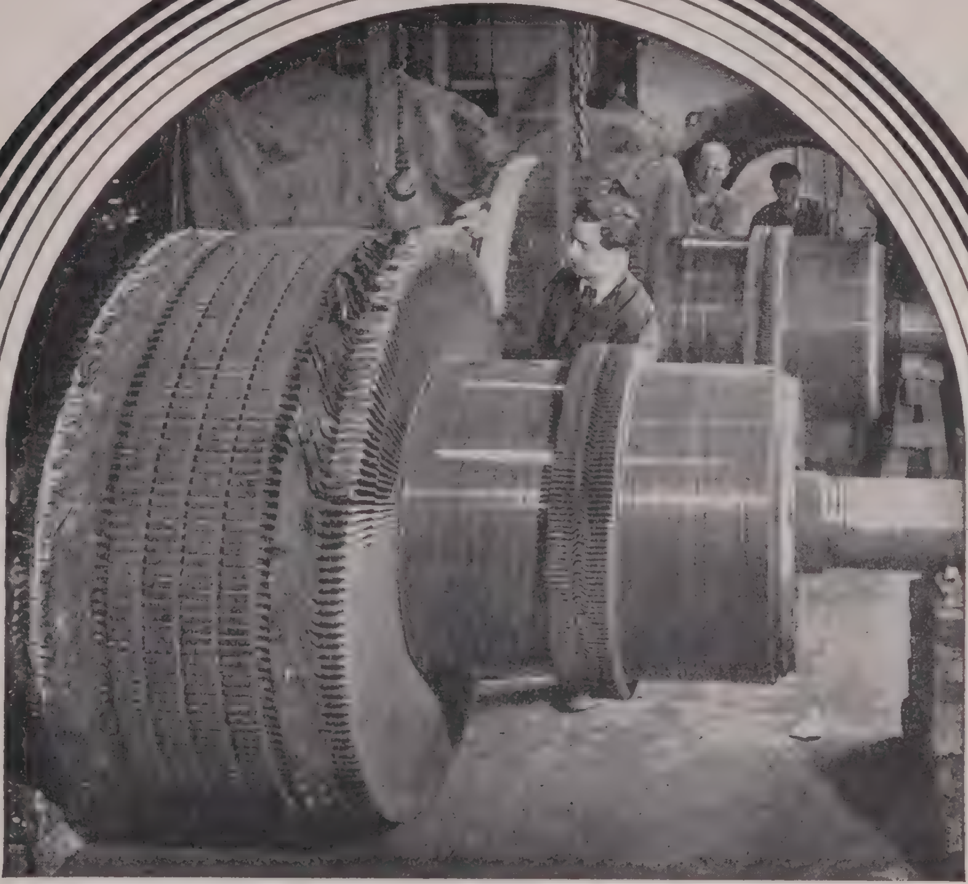

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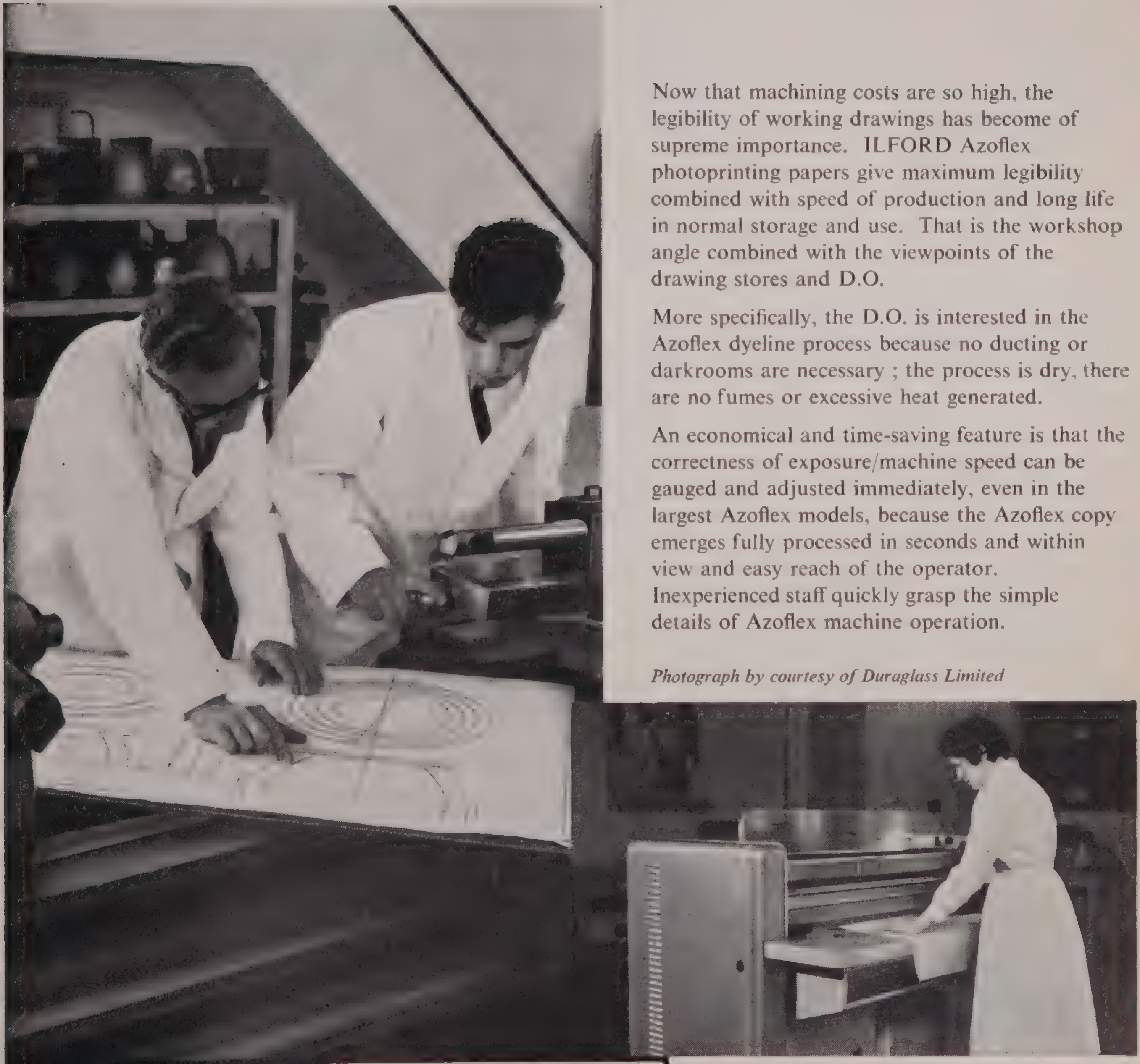

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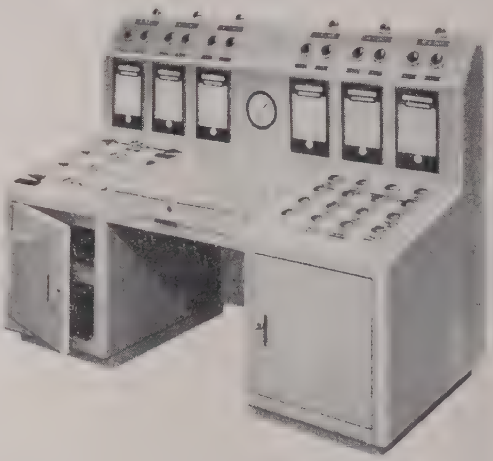

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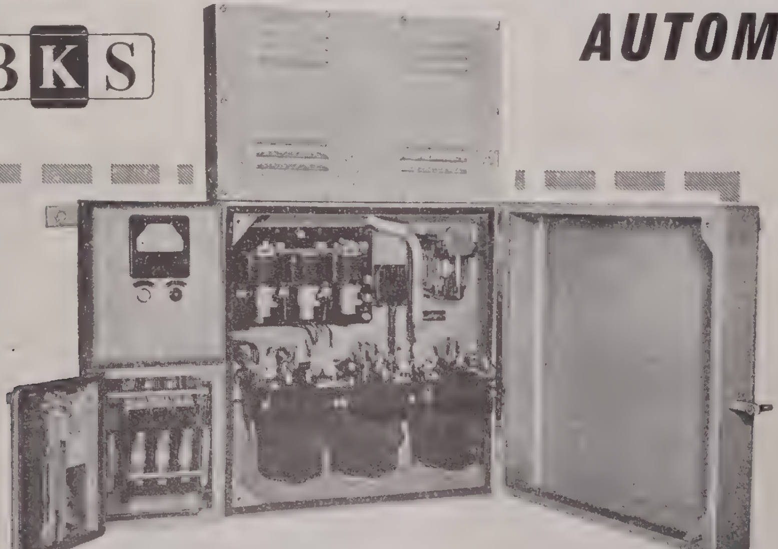

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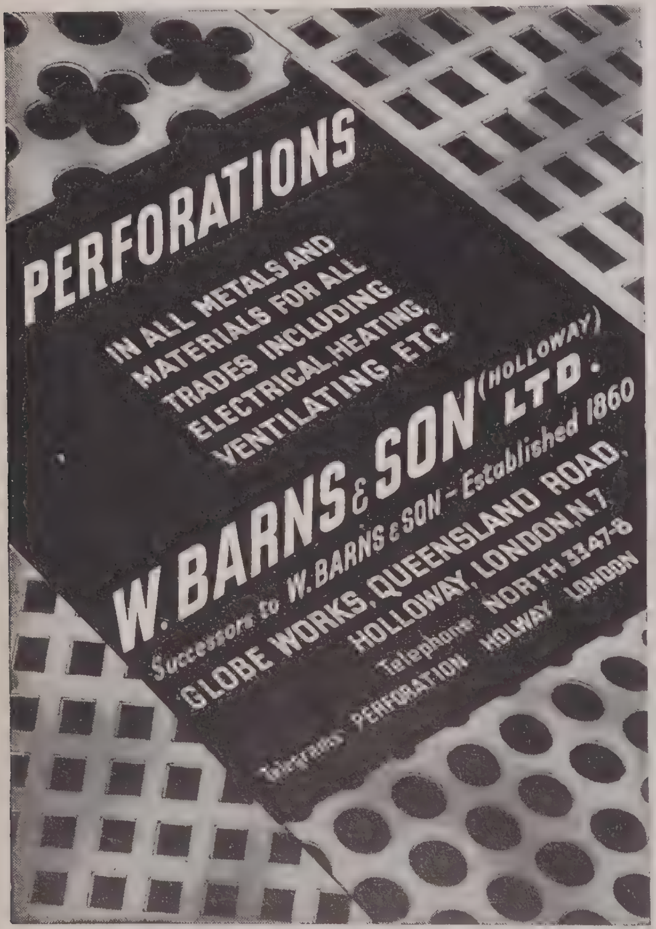

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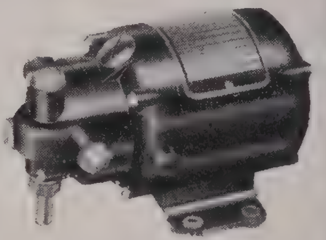

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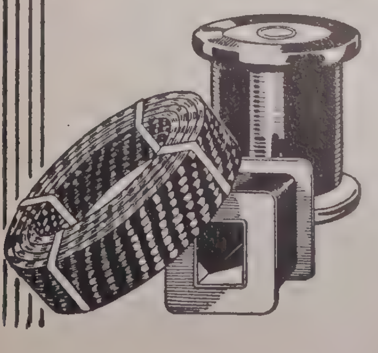

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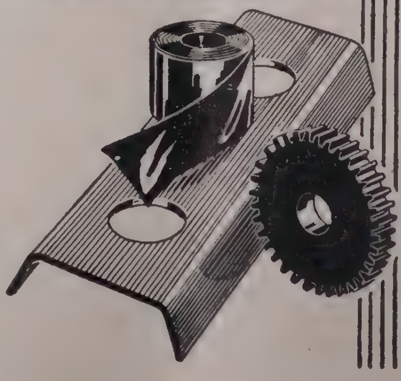

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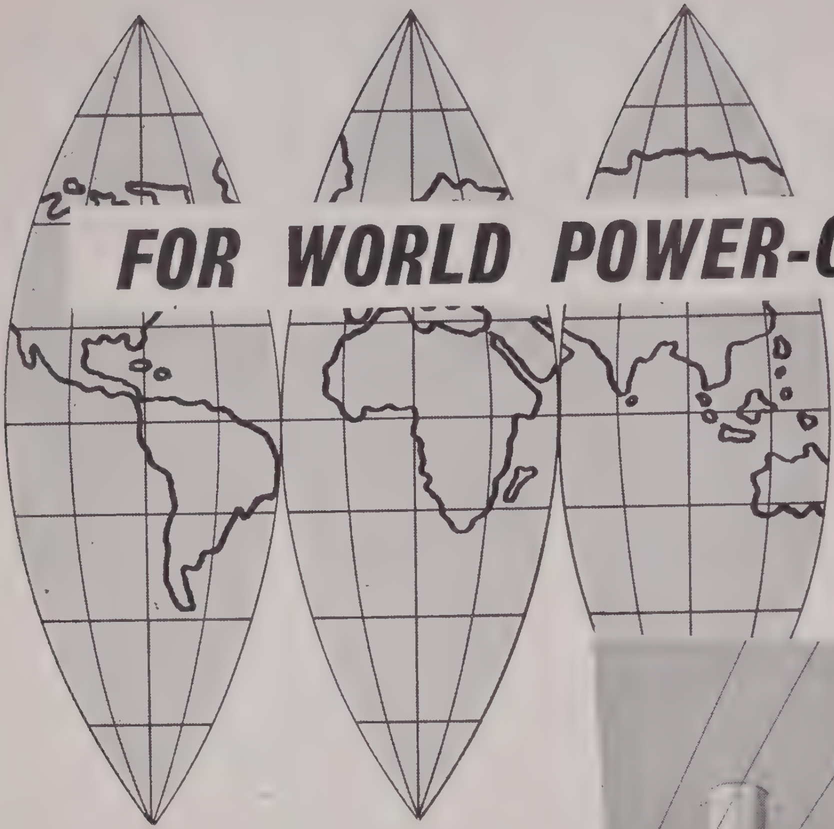

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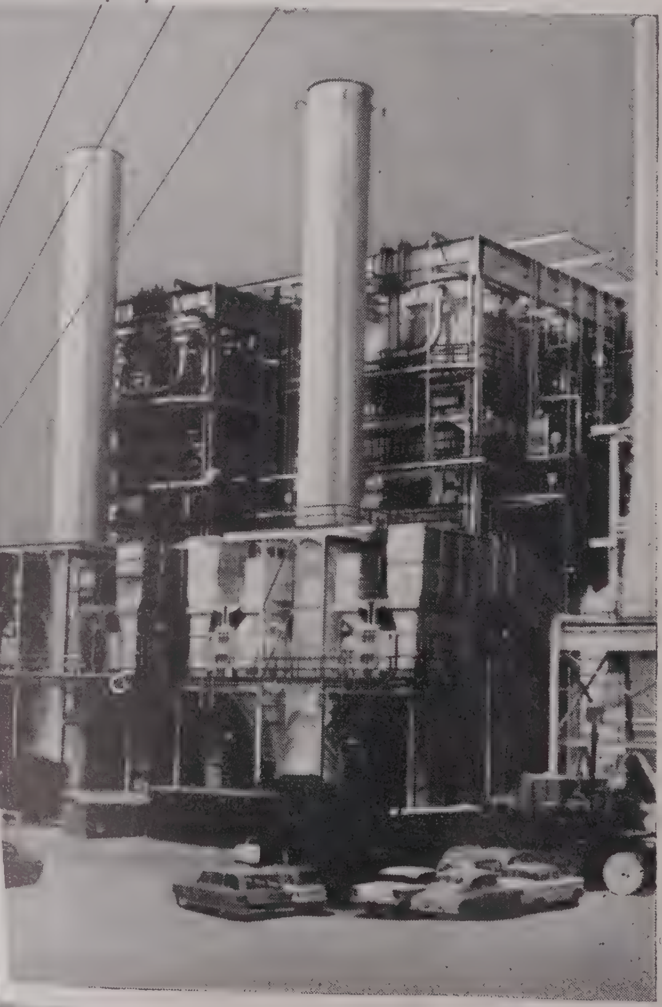
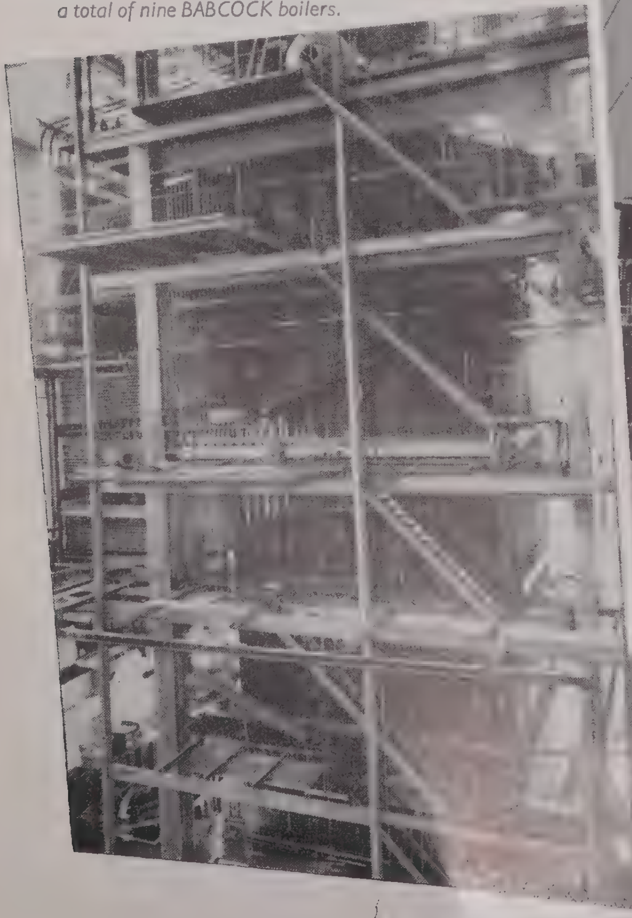
VENEZUELA (Right) *Two of the four BABCOCK Radiant boilers, natural-gas and oil fired, each rated at 550,000 lb./hr.; during erection for La Electricidad de Caracas. (Consulting Engineers: Sofina)*

AUSTRALIA (Below) *One of three BABCOCK Radiant boilers, each rated at 550,000 lb./hr.; during erection at Wangi power station, N.S.W., which has a total of nine BABCOCK boilers.*





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ELECTRICAL REVIEW

Friday 27 January 1961 Volume 168 No 4

Eighty-Ninth Year of Publication

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Telegrams Elecrev London-SE1 *Code* ABC

Please address correspondence to Editor, Advertisement Manager, or Publisher, as appropriate. Published weekly (Fridays). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter at the New York, U.S.A., Post Office. Price: 1s 6d per copy. Annual Subscription: Home £4 0s 0d; Overseas £5 15s 0d; U.S.A. and Canada $16.00. Cheques and Postal Orders payable to Iliffe Electrical Publications Ltd., and crossed "Coutts & Co."

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ELECTRICAL REVIEW

27 January 1961 · Vol. 168 No. 4 Established 1872

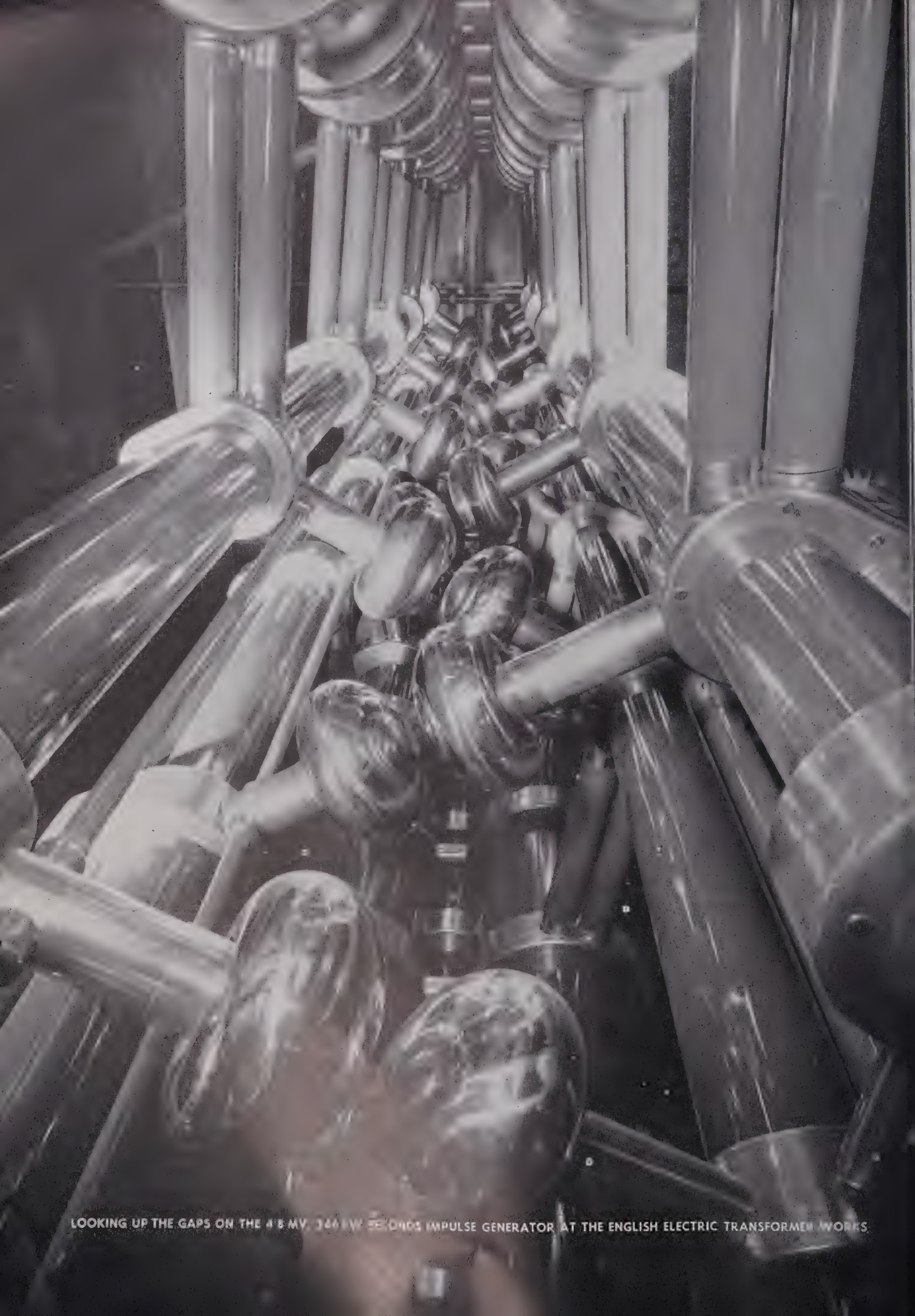
Background to Exports

DURING the past five years electrical and allied equipment, appliances and parts to a total value of £1,400 million have been sold overseas by British manufacturers. Unfortunately this considerable endeavour has not been sufficient to maintain Britain's proportional share of total world trade in electrical goods. There is, however, no danger of Britain being displaced as one of the world's three largest electrical exporters.

The main upward thrust in the world figure has come from the concentrated efforts which certain countries have made on particular markets, often in a limited range of products, and from the rapid growth in trade within the Common Market. By contrast, the export business of British electrical manufacturers has always been widely spread and covers the whole range of electrical and allied equipment. This is both a source of weakness and of strength, and it puts a premium on adaptability and resourcefulness.

Perhaps because of the high degree of protection which they enjoy at home, British electrical manufacturers have been somewhat slow to recognise the importance of trade in electrical goods between industrialised countries, which in recent years has shown the fastest growth. On the other hand their close technical and commercial ties with Commonwealth countries, and their continuing high level of investment there, can reasonably be expected to produce increasing returns as prosperity and industrialisation advance. The extension of the Dollar Exports Council to cover Latin America and the formation of a similar Council for Europe will lead to a fuller knowledge of the needs of these areas and the opportunities that exist there.

More significant is the attitude of manufacturers themselves. The importance of exports both to the national economy and to the prospects of the individual firm have never been more clearly recognised. Our own disinclination to take a too gloomy view of British electrical manufacturers' recent performance is based on our knowledge of the industry's technical capabilities and the efforts being made to improve the position. But trade statistics, though they are the criterion by which comparisons must be made, do not tell the whole story. The object of the articles in the following pages is to fill in some of this " background to exports."



LOOKING UP THE GAPS ON THE 4·8 MV, 344 KW SECONDS IMPULSE GENERATOR AT THE ENGLISH ELECTRIC TRANSFORMER WORKS

Progress in Electricity Generation

By SIR CHRISTOPHER HINTON,
K.B.E., F.R.S.

The chairman of the Central Electricity Generating Board discusses the technical and economic factors that are influencing the Board's present thinking on the development of the generation and transmission of electricity in England and Wales

A SURVEY OF CURRENT BRITISH PRACTICE AND POLICY

DURING the past twelve years the technological advances made in Great Britain in the design of generating plant have been striking. In surveying these advances it must be remembered that the decision to restrict the amount of generating plant installed during the war had left the country, in 1946, with a severe deficit in generating capacity. The immediate task was to make up this shortage in the most speedy manner and an interim policy of standardisation was adopted. Two sizes of machine were selected as most suitable for rapid manufacture and installation—the 30 MW set with steam conditions of about 750 p.s.i. and about 860°F, and the 60 MW set with somewhat higher steam conditions of 950 p.s.i. and 950°F. These machines were conservative in design and although they represented but small advance over the pre-war sets they were well suited to the conditions then prevailing.

Large Generating Units

After the nationalisation of the supply industry and the establishment of the British Electricity Authority in 1948, steps were taken to develop the design of large generating units more suited to the electricity transmission and load system. Tremendous advances were made in the years prior to the formation of the Central Electricity Generating Board. The cost of the power stations using 30 MW sets was about £67 per kilowatt and they had an efficiency of just over 27 per cent. At the time when the industry was reorganised in 1957 the Central Electricity Authority (which had succeeded the British Electricity Authority) had just placed orders for 275 MW units with efficiencies of about 37 per cent. Additionally, they had placed orders for two 550 MW turbo-alternators, although these machines each had two alternators. One of these is a fully cross-compounded machine, with a high-pressure line and a separate low-pressure line; the other is cross-compounded on the high-pressure turbines of the two lines only, both lines having identical intermediate pressure cylinders and exhaust cylinders. Since then technology has advanced further. Orders have been placed for 375 MW sets with single alternators, and within the last few months a 500 MW single-alternator set has come to be regarded as a standard for the future.

The developments which have made the use of these sets possible have been jointly carried out by the manufacturers and the engineering and research staffs of the Generating Board. They continue a downward trend in capital cost which has been in evidence since the early 30 and 60 MW machines. Current estimates indicate that the capital costs of the large " conventional " power stations now projected may fall to below £40 per kilowatt.

Station Planning

What is perhaps more important, these large units are causing a revision of thinking about station planning. Today planning is being carried out in terms of 2,000 MW power stations. For a coal-fired station of this size with the necessary sidings, coal stocking areas, cooling towers and switching station a site area of something between 300 and 500 acres is required. With a consumption of 100,000 tons per week, such a site must be near to the collieries and must also be associated with a rail transport system of sufficient capacity to carry the fuel needed.

This is the type of station that today is regarded as standard. But moving still further into the future, orders have been recently placed for two super-critical 375 MW sets. These use steam pressures of 3,500 p.s.i. with a temperature of 1,100°F and reheat to 1,050°F. The cost of these sets is rather greater than for sub-critical units of equivalent size but they will have slightly higher thermal efficiency. In considering these machines it is interesting to find that there is a developing conflict between advance in the conventional field and the nuclear programme. It would be fairly easy to justify the super-critical sets if a base load could be ensured for them throughout their life. But with the growing nuclear programme the greater part of the base load must be taken by nuclear power stations in order that they may generate at reasonable cost and we must therefore expect that after only a few years of their working life the super-critical stations will be operating at a comparatively low load factor. This has made the saving on this development only marginal but it is nevertheless considered worth while because it undoubtedly represents the next logical step forward in technology and because it is to the advantage of the electrical manufacturers as well as our long-term interests that this country should gain experience in this field.

Developments in the conventional field have been more exciting than those in the nuclear field where progress tends to be steady and anxious rather than exciting.

Nuclear Power Costs and Experience

The capital cost of nuclear stations continues to fall. The initial stations ordered by the C.E.G.B. and due for commissioning this year, Berkeley and Bradwell, are costing about £160 a kilowatt sent out, whereas the Dungeness contract was placed in last summer at a cost of about £110 a kilowatt. The cost of the latest station, at Sizewell, for which an order was placed in November, will be about £100 a kilowatt. Other nuclear stations are being built at Hinkley Point and Trawsfynydd for the C.E.G.B. and at Hunterston for the South of Scotland Electricity Board.

It must be remembered that while Dungeness and Sizewell are designed with two reactors, each of 275 MW electrical capacity, there is still today no operating experience except on the Chapel Cross and Calder Hall reactors with a capacity of 37 MW. Thus the extrapolation of design has been very rapid and experience of the Berkeley and Bradwell reactors is anxiously awaited. The development of advanced designs of reactors to succeed the Calder Hall type is being studied.

A comparison of the research and development effort devoted to bringing down the costs in the two fields of conventional and nuclear stations is somewhat disquieting. Available figures suggest that in the conventional field these costs are of the order of 5 per cent of the capital value of power plants built. On the other hand, if it is assumed that the cost of the nuclear sections (i.e. the cost of the reactors and heat exchangers) of the nuclear plants built for the Central Electricity Generating Board in the years from 1965-1975 is rather less than £50 million per year, it seems improbable that research and development costs (including the work of the manufacturers, the Atomic Energy Authority and the Generating Board) will be less than 30 per cent if effort is maintained at its present level.

Research and Development

In the Central Electricity Generating Board the Research and Development Department is regarded rather as being the intelligence and reconnaissance unit of the industry. Since the Board was formed the research staff has trebled, an enlargement vitally necessary with the high rate of technical advance which is being aimed at.

No. I reactor at Berkeley nuclear power station is nearly completed. Fuel loading is due to begin in late March and the reactor should be at full power by the end of September. Both Berkeley and Bradwell (opposite) are being built by the Nuclear Power Group

New laboratories are being built at Leatherhead which will be mainly concerned with research work in the conventional field. At Berkeley, near the 275 MW nuclear station, a nuclear research laboratory is being built to carry out work in that field. About 25 per cent of the research effort of the Generating Board in 1960-61 will be concerned with nuclear problems. Reactor materials both fissile and non-fissile will be an important part of the programme. It will be necessary to watch the chemical reactions of graphite with the gases in the cooling system, and changes in the characteristics of the graphite moderator and the thick steel plate of the pressure vessel will be studied by examining many thousands of samples which will be placed in the reactor before commissioning and withdrawn over the years.

This work is in addition to that of the reactor physicists who will be engaged in investigating reactor core designs and of the health physicists who will gather and interpret data from the earlier stations. Advanced instrumentation needed for the speedy commissioning and efficient operation of reactors is another subject of major importance. Much work also remains to be done on the mechanical development of fuel elements and on the design of improved heat exchangers and pressure-circuit components.

400 kV Transmission

In the transmission field additional high-voltage laboratories are being built at Leatherhead because one of the ways of ameliorating the amenity problem in connection with overhead transmission lines is to use higher transmission voltages and so minimise the number of additional lines required. Work is already in hand to uprate to 400 kV the existing High Marnham-Monk Fryston 275 kV line (which passes through a great variety of atmospheric conditions) so that information may be gained on pollution on the insulator systems.

Investigations are continuing into various advanced steam cycles, among them the Field cycle, the fuel cell and the plasma system of generation, but the last two projects can be regarded only as very long-term research.

The research teams are continuing to work on the combustion and transport of fuel and on atmospheric pollution; it is surprising to find that although it has been used for so long there are still many unknowns about the burning of coal. Then there is the considerable problem of the disposal of pulverised fuel ash of which 20,000 tons per week is produced at a big modern power station. Work is being directed towards the use of p.f. ash in brick making, as a part substitute for cement in concrete, as ballast for filling (where it is not being used sufficiently) and research is also being done with considerable success on growing crops on p.f. ash dumped as fill for gravel pits or for land levelling.

Again it is quite surprising to find such a scarcity of knowledge on the effects on biological life of the Board's warm water discharges into rivers and estuaries. The circulating water is, of course, discharged at a slightly higher temperature than that at which it is abstracted, and there is scope for research both into biological effects and into heat dissipation.

But also, to avoid the use of circulating water and to give additional freedom in the siting of power stations, the Board is building a dry cooling tower at Rugeley. This uses water-to-air radiators in the tower instead of the self-

The fuel charge/discharge machine above the pile cap of No. 1 reactor at Bradwell nuclear power station, which is also due for commissioning this year evaporation principle used conventionally. The associated turbo-alternator will use jet-type condensing plant and care will be necessary to prevent any contamination of the feed water.

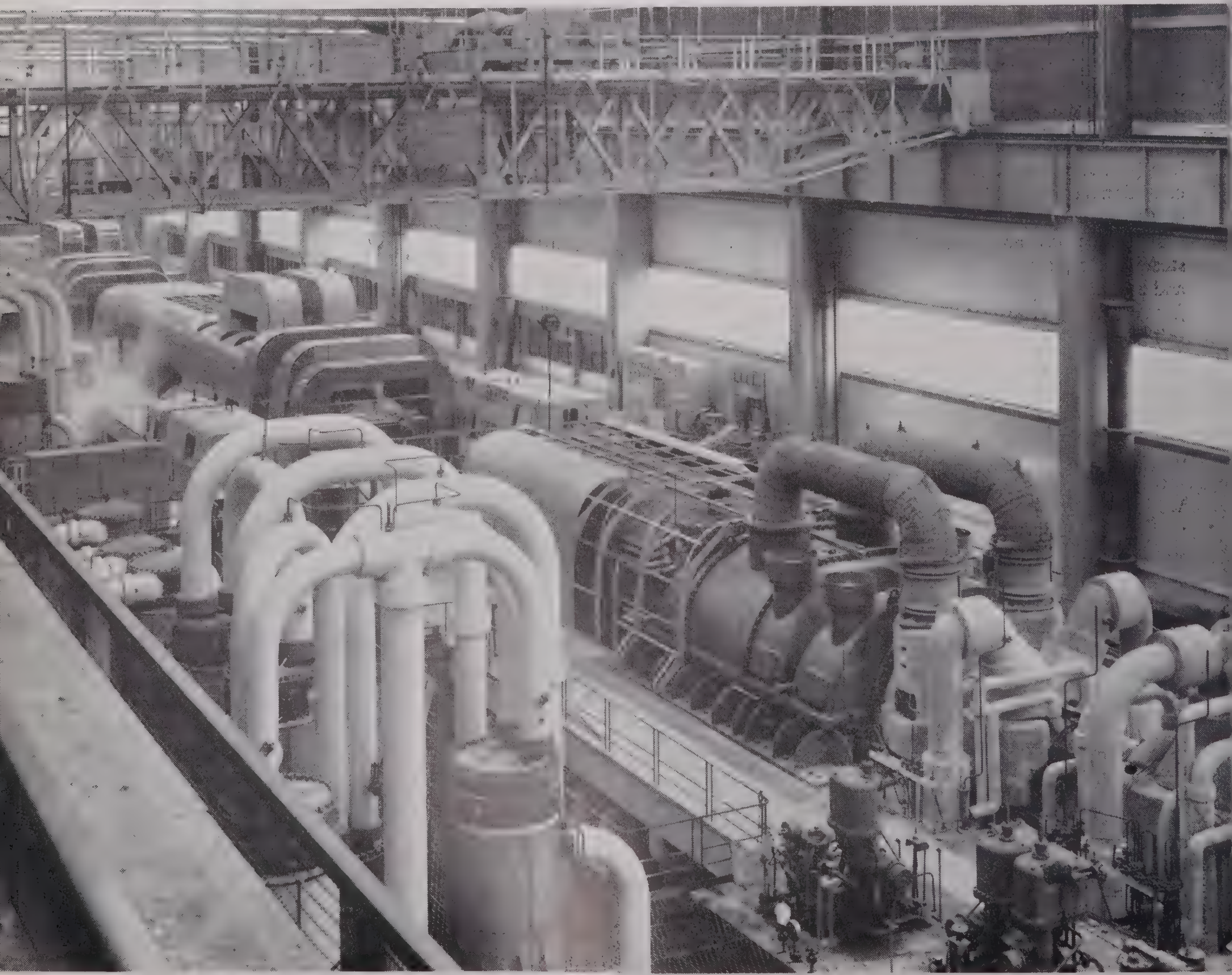
Computing Services

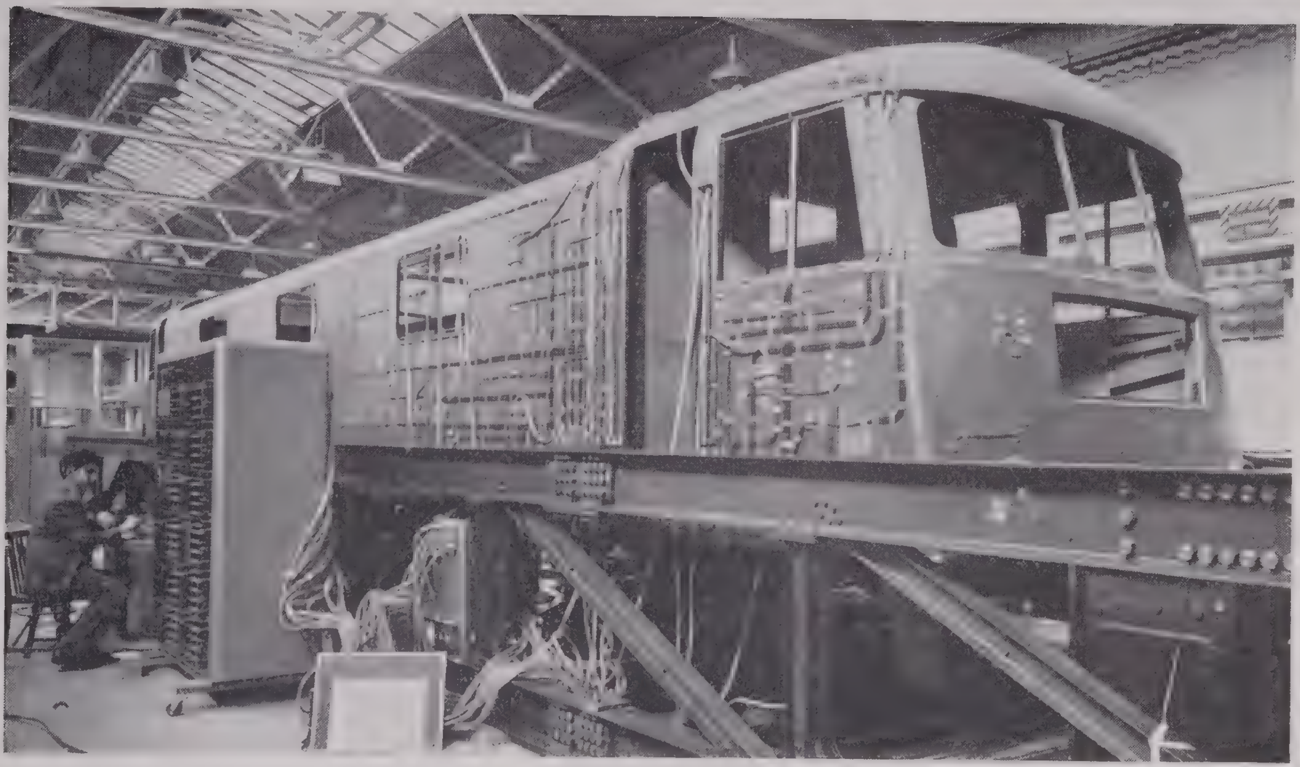
Requirements of reactor design and of numerous other problems have led to a great expansion of computing facilities. In addition to the Deuce computer, which has now been operating for several years and continues to prove a useful instrument, the Board is now operating a large I.B.M. 709 computer which is among the largest digital general-purpose computers yet designed. With the very high calculation rate possible and the large memory storage, this machine is proving invaluable in carrying out the complex and tedious calculations associated with the operation and design of nuclear reactors.

As a long-term project, consideration is being given to a computer system which will automatically operate the whole of the Board's generation and transmission system at maximum economy. Preliminary calculations have indicated that coal savings amounting in terms of money to many thousands of pounds should be possible.

It is becoming increasingly difficult in the United Kingdom to find suitable sites for today's big power stations and to negotiate routes for the transmission network, yet the demand for electricity continues to grow at the historic rate which results in the load doubling itself every ten years. The general trend for the construction of new plant to meet this load will be to site conventional stations close to the coalfields, and nuclear stations, which need so much more cooling water, on the coast or tidal estuaries. The capacity of the national grid must be greatly increased to transport the additional load and a decision has recently been taken to adopt 400 kV for future main transmission. The complexity of the supply problem is underlined by the fact that the steepest rise in the demand for electricity is found in the South of England, away from the coalfields, and the most economic way of meeting some of this demand might be to build further oil-fired stations since heavy fuel oil is a far cheaper source of heat than coal in the South of England. Greater flexibility of planning becomes possible as we move into a three-fuel economy and in expanding the system to meet future demands a judicious balance between coal, oil and nuclear fuel must be achieved.

1,000 MW Power Station. Three of the eventual five 200 MW English Electric turbo-alternators at High Marnham





An a.c. locomotive cab undergoing strain gauge tests. At the left is the digital strain gauge recorder

IN SUPPORT OF THE PRODUCT

By H. M. MATHEWS, C.I.E., M.I.E.E.

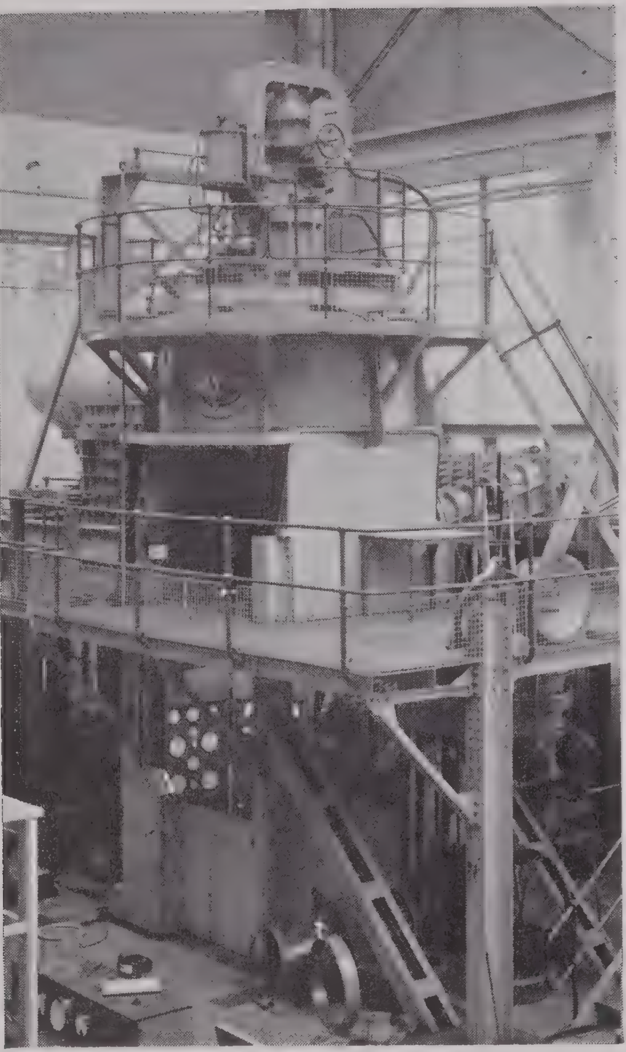
The Director of Engineering, English Electric Co., Ltd., describes how large manufacturing organisations, by virtue of their size, can draw on extensive specialist services to back up their engineering effort, both before and after sale. This results in improved quality of the product which is not always apparent to buyers either at home or overseas

LARGE-SCALE DEVELOPMENT AND TESTING

OVERSEAS purchasers of heavy electrical equipment are occasionally apt to assume that all that is required to undertake an order is a design office and a manufacturing plant. In fact much more is required, for example, the provision of research, development and testing facilities. Heavy electrical installations are increasing steadily in power from year to year, and this results in technical problems much more formidable than those associated with the provision of suitable manufacturing facilities. The overall rate of investment thus more than keeps pace with the increase in plant size.

Steam turbo-alternator sets are already capable of delivering more than 350 MW; both electric and diesel-electric locomotives are available with powers in excess of 3,000 h.p. from a single unit; switchgear and transformers are already available for operation at 400 kV; rolling mills and similar industrial plant are steadily increasing in physical size and throughput, calling for more powerful motors. The increase in size of these plants and units puts even greater emphasis on reliability. Breakdowns, or even undue time out of service for routine maintenance, assume much greater importance than ever before. The result is that manufacturers of large electrical installations are spending more time and money on developing and proving their products. The testing and re-testing that all large plant now undergoes during manufacture has one main aim: to ensure that the finished plant will reliably do the job for which it was designed.

Development of switchgear for interrupting capacities in excess of 10,000 MVA is a particularly expensive opera-



Large cavitation test rig at the English Electric Hydraulic Research Laboratory, Rugby. Pressure water for the 21 in vertical turbine is supplied by a 600 h.p. pump

tion. New and advanced designs of high-power switchgear are not produced by theoretical work alone, but demand the help of experimental testing at each step. Finally, it must be demonstrated to the customer, or an independent authority, that the breaker will work at its rated interrupted capacity. This calls for the use of very-high-power testing facilities, the cost of which can only be borne by a large organisation.

In power station practice every turbine and alternator manufacturer is required to test both electrical and steam rotors at overspeed in order to ensure that the bursting strength is well outside any operating condition. This entails the provision of massive test houses, and raises particularly formidable problems in driving power with the large low-pressure steam rotors now in production. Indeed, the chamber in which these are overspeeded must be evacuated in order to reduce windage and to keep down the power to reasonable proportions.

Behind the design groups, and mostly unseen by the customer, lie other facilities such as wind tunnels, metallurgical laboratories and hydraulic research laboratories. Water-power problems of erosion, cavitation and performance are solved in the hydraulic research laboratories, using scale models.

The physical size of the product does not necessarily reflect the size and scope of the development laboratories needed to support it. A typical example is that of electrical equipment for aircraft, where not only is maximum performance for minimum size and weight a design factor, but operation is required in an environment totally different from that at ground level. The environment must be simulated in specially designed chambers where the required pressure, temperature and humidity can be maintained while the equipment is run at full rated power.

For some products the real trial is in service, and for this reason it is sometimes necessary for the manufacturer to build expensive operational prototypes. One example is a high power/weight ratio diesel-electric locomotive of advanced design, which is in regular service in the United Kingdom; another is a narrow-gauge diesel-electric locomotive with light axle loading which is making a world-wide demonstration tour. These are both producing invaluable data from operational conditions for their makers, as well as being a useful, if expensive, " shop window " for potential customers.

Computers Widely Used

Electronic and other computers are now widely used for design and development work and also for performance calculation. In electric traction, train performance calculations on either analogue or digital computers provide data on power consumption, the heating of the electrical equipment and train timings, from which the railway administration can make up timetables. It would probably be uneconomic for a railway to buy its own computer for these performances, but the large manufacturer has such a diversity of work which can be more expeditiously done by using computers that their use is more than justified.

The illustration on page 139 shows a traction testing programme that owes much of its success to analysis by digital computer. Loads of several hundred tons are artificially applied to the locomotive frame, and the effects on the strain gauges are automatically read off and turned into punched-card information by a digitised strain-gauge recorder. These cards are subsequently fed into a digital computer which calculates, for each gauge position, the principal stresses and stress directions.

The whole process of recording and analysing experimental data has been so mechanised in this way that what was formerly the work of years can now be finished in weeks. This is not only a valuable saving in time, but it also eliminates all sorts of difficulties due to variations in the environment that would otherwise affect the accuracy of the tests. In fact, it is most probable that without such mechanisation a programme of this magnitude would never have been undertaken.

Digital computers are now being widely used by large manufacturers for design studies on a.c. and d.c. machines, transformers, steam turbines, diesel engines, water turbines and airframes. Analogue computers, being on the whole smaller and cheaper, are even more widely used, often to observe performance, process or controls in " real " time, that is under the timing conditions that actually apply. Computers of this sort can be used to simulate any closed-loop control system such as, for example, those encountered in the control of a modern steel mill.

An exceptional analogue computer is the English Electric "Saturn," the largest analogue computer in Europe, and possibly the largest in the world. It has over 1,500 amplifiers, and is mainly used for carrying out vitally important stability analyses and control system studies for atomic power reactors.

Network Analyser Simulates Complete System

A rather specialised type of analogue computer is the a.c. network analyser. This has been used mainly on the analysis of large electrical power generation, transmission and distribution systems, but its use is now spreading to much smaller a.c. networks. For example, the electrical system for a complete rolling mill installation can be simulated and the arrangement modified to minimise peaks of power consumption.

The whole proposed network is simulated on the analyser in each case. Normal load flow can then be studied and also the effect of faults occurring at different places. In some cases the stability of the whole system might be affected by faults or even by sudden changes of load. The results of the study are embodied in a report which is sent to the customer. This report advises him how to carry out the planned expansion, what effect it will have on the existing system, and specifies the ratings of the necessary equipment.

Metal Creep

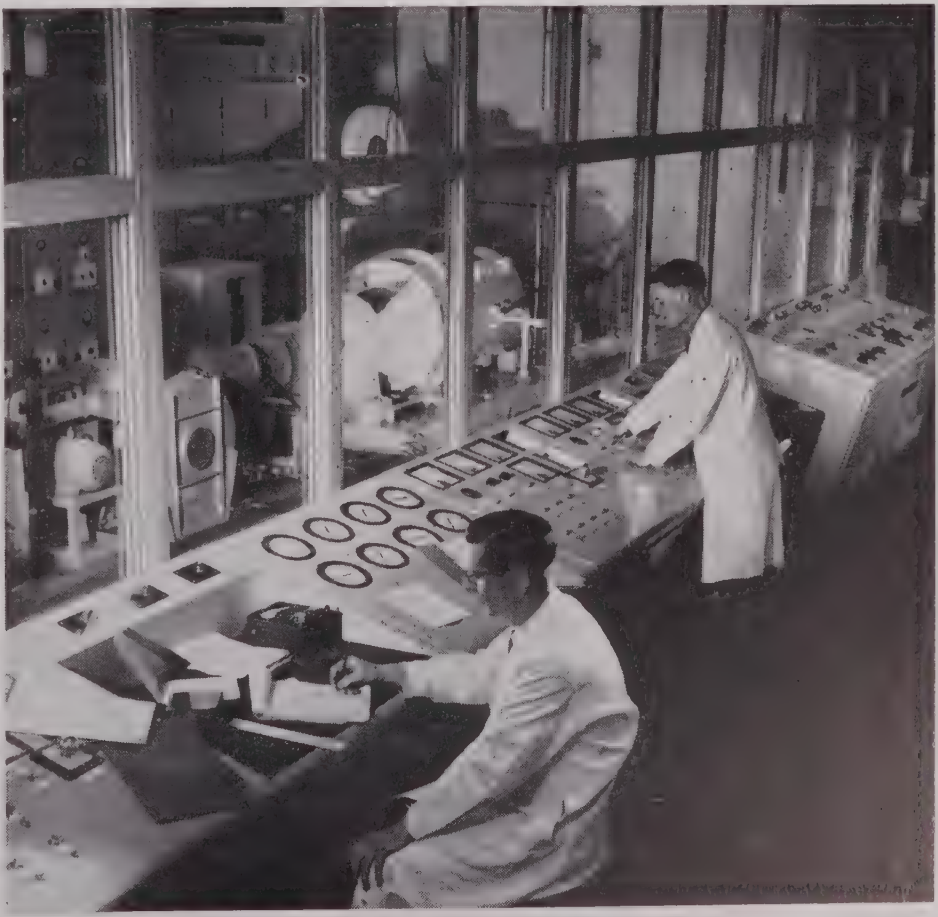
Because of the phenomenon known as metal "creep" all large engineering organisations maintain one or more creep test laboratories. In any high-speed machinery, but particularly in steam turbines, gas turbines and internal combustion engines, metallic parts are subjected simultaneously to high temperatures and high stresses. Under these conditions the metals stretch or creep by minute amounts over perhaps several years.

It is not sufficient for the laboratory to observe the creep of an alloy at a certain load and temperature for a time and then extrapolate. Some alloys elongate steadily, but others snap suddenly, at the end of their life. Therefore, whenever it is proposed to use a new alloy the creep test laboratory is called in to make extensive tests at the relevant loads and temperatures. This work will be started well in advance of the manufacture of the actual machine and before the machine goes into service many thousands of hours' experience will have been built up. Tests continue for many years and, in the event of failure of the test pieces, adequate warning will be given for the machine to be taken out of service before any damage is done. Similar tests are also carried out if a machine is expected to meet a particularly exacting operational requirement.

In the larger sets now being built even known materials are being subjected to higher stresses. It is thus most important to be sure that the material actually used in the machine will perform satisfactorily. To check this, test pieces are taken from the highly stressed parts and subjected to creep tests in excess of 10,000 hours.

Contract Co-ordinating Services Available

Some of the large electrical manufacturers in this country maintain sections of their export offices, or even special planning groups, who will co-ordinate all of the work (civil and mechanical, as well as electrical) for any contract, of any size. Specialised product divisions of these large organisations also often have their own comprehensive contract groups, who will collaborate with other engineering contractors, and, if required, co-ordinate the work for the whole installation.



Control panels for an aircraft electrical system test rig

THE ELECTRICAL INDUSTRY'S CONTRIBUTIO

Investment in Local Manufacture

In addition to exporting equipment for the generation and utilisation of electricity, the British electrical industry has helped considerably to raise living standards in many of the less-developed countries by setting up local manufacturing plants of its own and by the provision of technical assistance. Mr. Risoe is a director of Associated Electrical Industries Overseas, Ltd.

THE so-called under-developed countries have, during the past ten years, stepped up their efforts to raise their standard of living to a remarkable extent, primarily by increasing power supplies and by encouraging local manufacture.

Do we in Britain lament the passing of the "good old days" when these countries—our traditional markets—imported all their electrical equipment, or do we accept that, of necessity, they will develop industries to produce goods that were previously brought from us ?

In practice we are left with little choice. For though British electrical manufacturers may sometimes regret these developments they cannot afford not to participate in them wholeheartedly. Industry in Britain, as in the other industrial countries, is faced with the dilemma of deciding whether it hurts less to assist an erstwhile purchaser to set up his own manufacturing plant, or to refuse to help and see him find someone else.

Aid to the development of electrical manufacture in other countries is not something new and in the decade following the first world war one well-known British manufacturer negotiated technical aid agreements with Russia covering both steam turbine plant and electrical equipment. Many British firms have had licensing arrangements in various countries in Europe and elsewhere for many years.

This is, after all, an inevitable pattern of progress, and even in Britain many branches of industry, particularly those associated with new developments, owe much to the participation of foreign firms. Some of the biggest manufacturing units in the British electrical industry today started as English affiliates of foreign companies, and it is true to say that most other industrialised countries have had similar experiences.

The real point is that a highly-developed country will always provide better markets than a backward country. Once this has been recognised, all that is then necessary for a firm to decide is the extent and manner of its participation in a country's development. It can be done either by inspiring and initiating new forms of industry, or by taking advantage of progressive ideas which may originate locally.

A firm's local representatives should be able to advise when the time has come to take the initiative. If the first move is with the company, it could consider setting up a manufacturing subsidiary of its own; helping to establish a partly-owned manufacturing company with some local shareholding; making technical agreements with a locally-owned manufacturing company; or suggesting a joint venture with a local concern on specific financial terms and with a technical agreement.

If the initiative comes from the country itself, there is the possibility of arranging manufacturing licences for specific products, manufacturing agreements on a general product basis or joint ventures with local concerns on specific financial terms and with technical agreements. If manufacturing agreements are entered into, payment could be made either directly or in a way which could build up British participation locally.

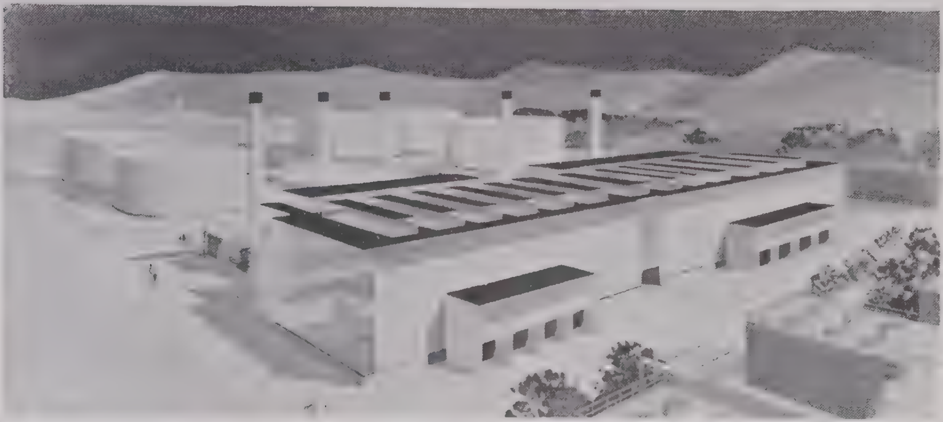
Since the second world war, British Government assistance and private investment in less-developed countries has totalled some £2,500 million. Government assistance increased rapidly from £80 million in 1957-58 to nearly £140 million in 1959-60. Total private investment has been averaging some £300 million a year over the last seven years, of which about £100 million a year has been invested in less-developed areas. The bulk of United Kingdom assistance has gone to Commonwealth countries.

Remarkable results are being achieved in India, where the fact that more British technicians and other staff are employed now than before India achieved independence demonstrates the extent of collaboration. The Durgapur steel plant and the Bhopal heavy electrical manufacturing centre spring to mind as two projects in which British

Part of the factory at Bhopal, India, of Heavy Electrical, Ltd., which was opened in November last year

TO ADVANCING INDUSTRIALISATION OVERSEAS

By
V. S. RISOE
M.B.E., B.Sc.(Eng.), M.I.E.E.



An artist's impression of the Cuidad Juarez Power Station, which A.E.I. are to build in Mexico

advice, training, machinery and financial assistance have provided new manufacturing capacity. At Durgapur, I.S.C.O.N., a consortium of well-known British firms, is building the biggest single British project in India in which nearly £30 million is directly invested by the United Kingdom. The Indians are already planning to raise the eventual production to 1,600,000 tons of steel a year instead of the 1,000,000 tons which was originally envisaged.

The plant being built at Bhopal is designed to produce enough electrical machinery to supply the major portion of India's needs, and it will, in fact, be the largest manufacturing centre of its kind in Asia. The scheme was first conceived by the Indian Government in 1948, but had to be deferred because available resources were required for other purposes. The British group, Associated Electrical Industries, Ltd., were selected as consultants in 1955 and their detailed report, presented the following year, was finally accepted in 1957. Selection of a site, methods of training, details of plant and equipment required, appointment of subsidiary consultants, and purchase of imported machinery required were all handled by A.E.I.

The training of Indian staff, both in the United Kingdom and locally, was essential to the success of the project. It involved the provision of intensive courses in England for nearly 200 senior technicians and the electrical education of thousands of artisans and engineers of all grades in the splendidly-equipped training school and workshop in Bhopal.

Australia, as might be expected, has a long history of association with British electrical firms, who have to a large extent been responsible for building the country's rapidly-growing number of power installations. Many British firms have found it advisable to form subsidiary companies there and local manufacture is being undertaken on an increasing scale. The first large nuclear research reactor in Australia was built by Head, Wrightson & Co., Ltd., but the establishment of a nuclear organisation by the Australian authorities and the training given to scientists and engineers by the United Kingdom Atomic Energy Authority and by private firms will lead to the design of further projects being undertaken in Australia. The links which have been formed will undoubtedly lead to the adoption of many British techniques and probably to considerable use of licence rights.

Examples from outside the Commonwealth can also be quoted. Mexico is a country which is not usually associated with heavy industry. But the present Government has embarked on an ambitious industrialisation scheme which involves the construction of power stations for the central electricity organisation. The biggest station yet planned is at Ciudad Juarez, and it is gratifying to know that despite Mexico's proximity to the United States, the contract for the design, construction and supply of generating equipment for this 100 MW power station was awarded to a British firm.

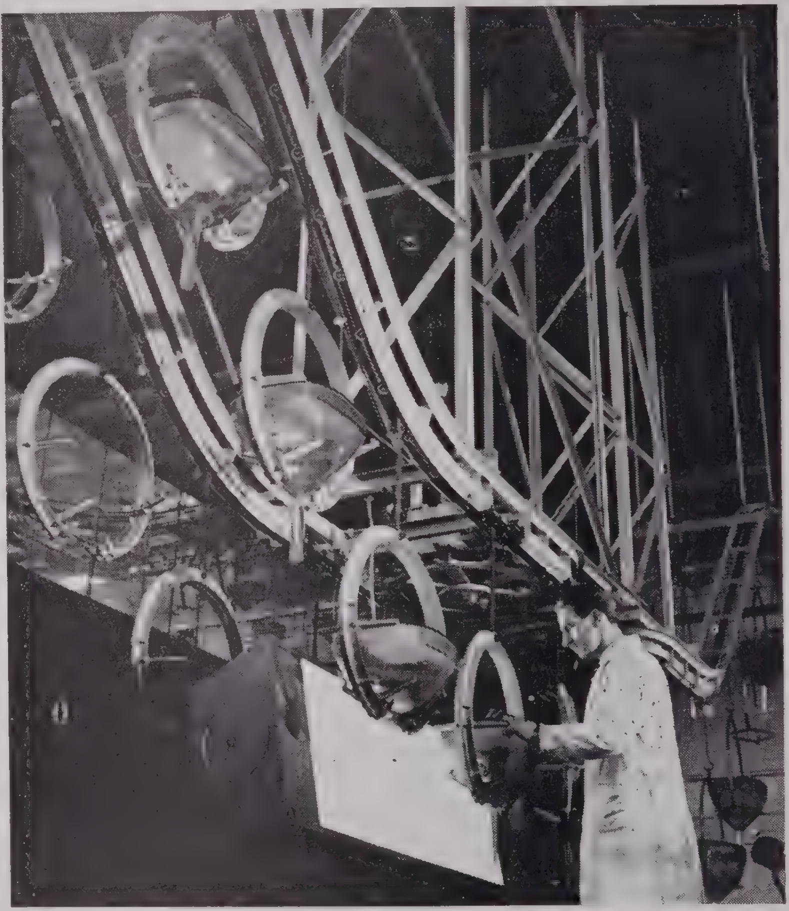
When the Japanese decided that they could increase their power supplies by taking advantage of developments in nuclear energy, they asked for advice from both the United States and Great Britain, and they received considerable co-operation both from the United Kingdom Atomic Energy Authority and from the consortia engaged in this new industry. Eventually the contract for their first atomic power station was placed with the General Electric Co., Ltd., and the fact that here there were already ties with Japan, especially on the civil engineering side, must have had an important influence on the decision. In order to learn the new techniques, the Japanese must inevitably develop close links with British engineers and scientists. However rapidly they progress themselves, they must, for a long time, continue to rely on the practical experience of the British firm.

British equipment and machinery, for the generation, transmission and utilisation of electricity, can be seen in all parts of the world and it has helped to build up national industries. With the growth of local manufacture, standards of living have been raised, and as they continue to rise, so will demand increase. The pattern of supply is, however, likely to change, as has already happened in Australia and South Africa, and there will be a greater emphasis on the export of larger and more complicated equipment and on the supply of kits of parts and components for local assembly. Financial rewards to compensate for any loss in the volume of commodity exports should also be obtained from the sales of more advanced designs and from agreements for the use of patents, etc. Because of her long and continuing tradition of research and development, Great Britain will still have a major contribution to make to the development of electricity supply and manufacturing industry overseas.

Processes of Manufacture

CRAFTSMANSHIP AND MASS PRODUCTION

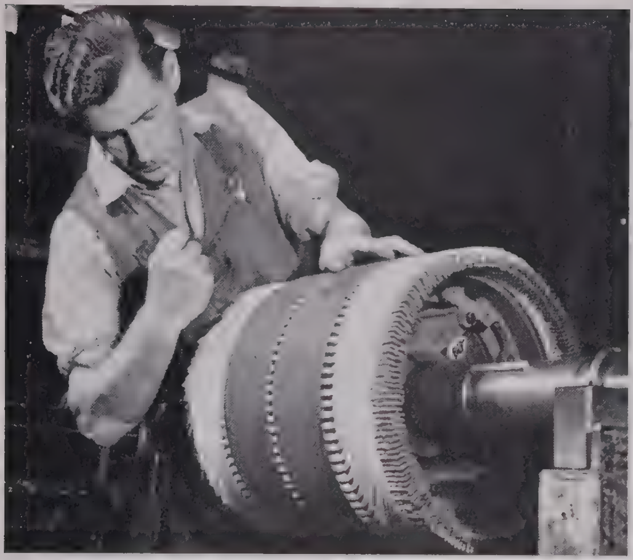
MANY READERS, and especially those who do not live in an industrial country, will have only rare opportunities for seeing the great variety of processes used in the manufacture of electrical equipment and apparatus. The following photographs and those on pages 160 to 162 will help to convey some idea of the facilities that exist in the factories of British electrical manufacturers and the methods adopted. They show not only how modern techniques and particularly quantity production are being applied to an increasing range of products, but also the extent to which individual skill and traditional craftsmanship are still essential



Examination of the fluorescent screens of television tubes is carried out while the tubes remain on the conveyor system. (Mullard, Ltd.)

Fitting blades to a steam turbine wheel for a 120 MW machine at the A.E.I. Trafford Park works

BACKGROUND TO EXPORTS



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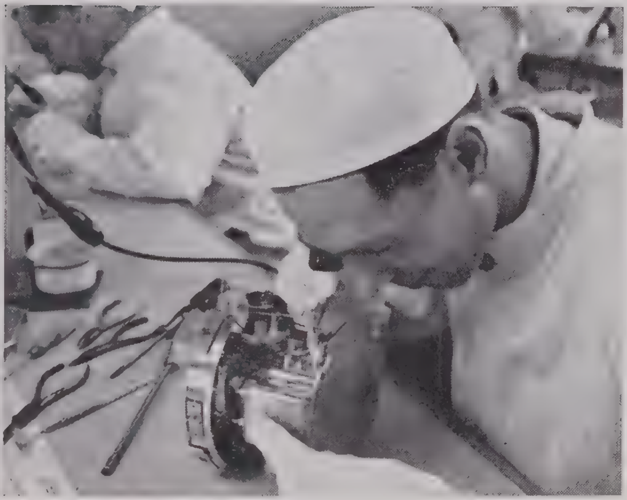
Bar winding the rotor for a large slip-ring motor. The insulated copper bars are inserted in the slots and carefully formed to the correct shape. (Brook Motors, Ltd.)



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The special area in the Standard Telephones & Cables factory at North Woolwich, where repeaters for under-sea telephone cables are manufactured under near-clinical conditions

33 kV solid-type cable being armoured with galvanised wire at the Erith works of British Insulated Callender's Cables, Ltd.

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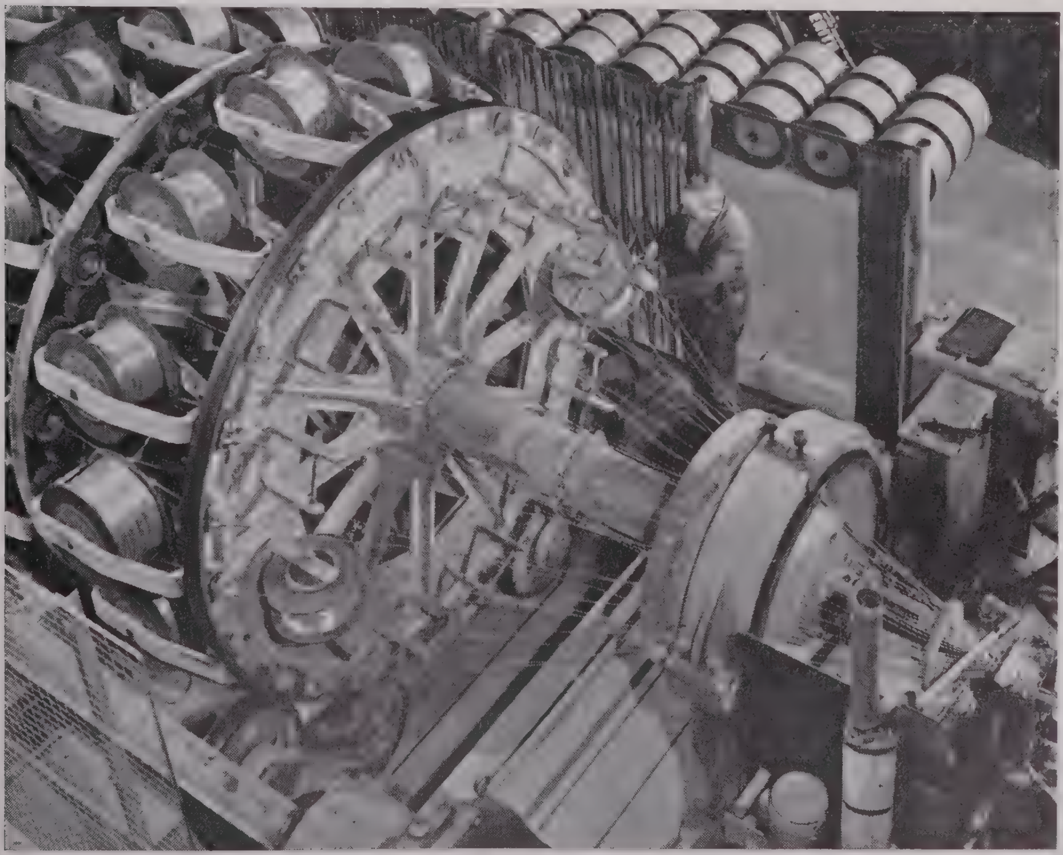
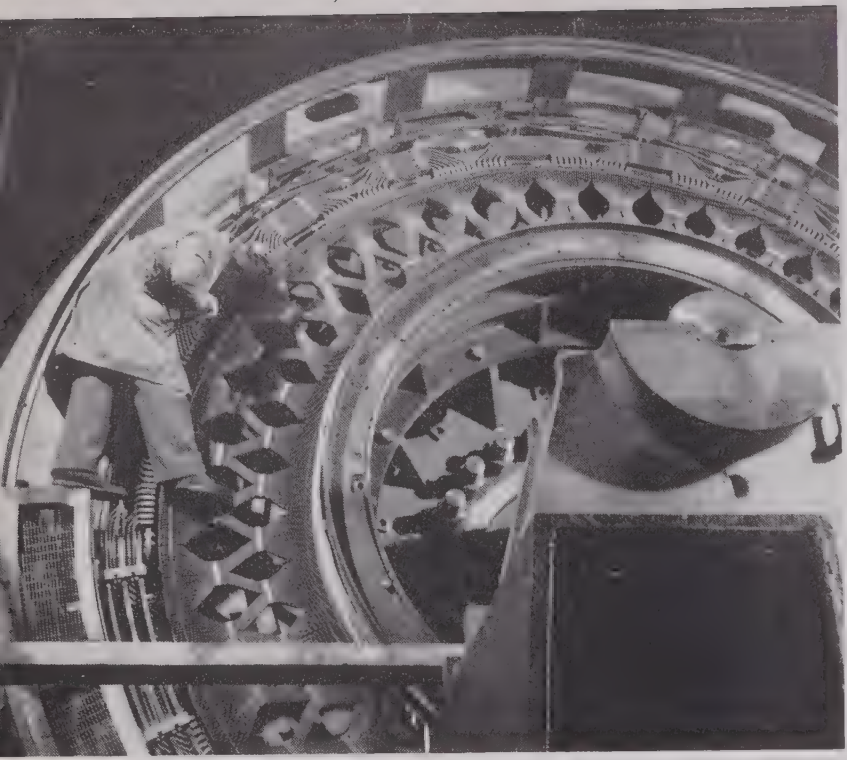
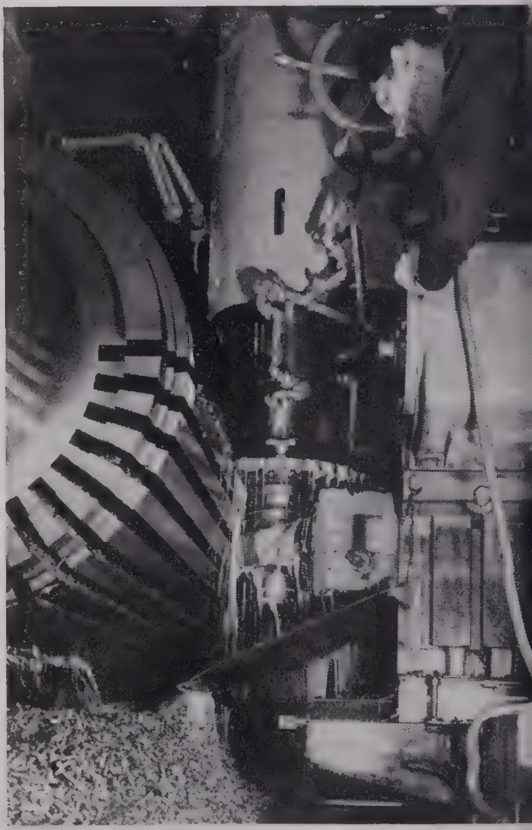


BACKGROUND TO EXPORTS

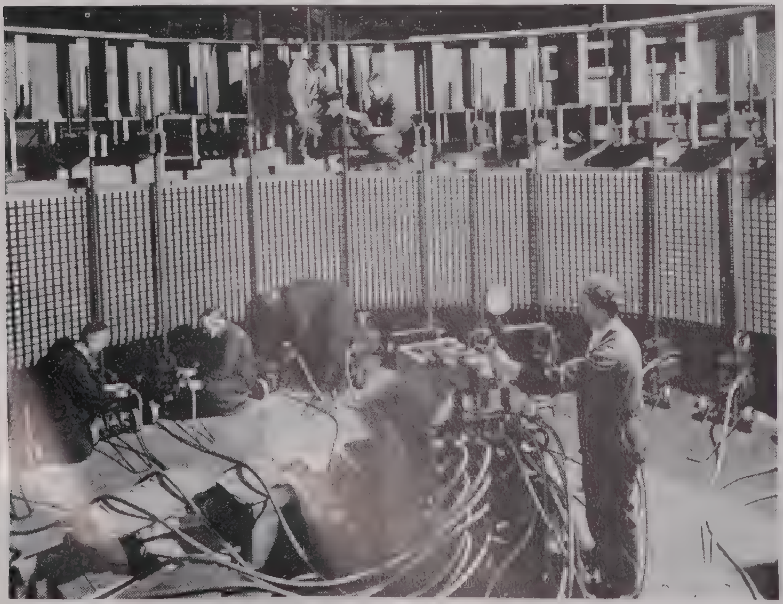


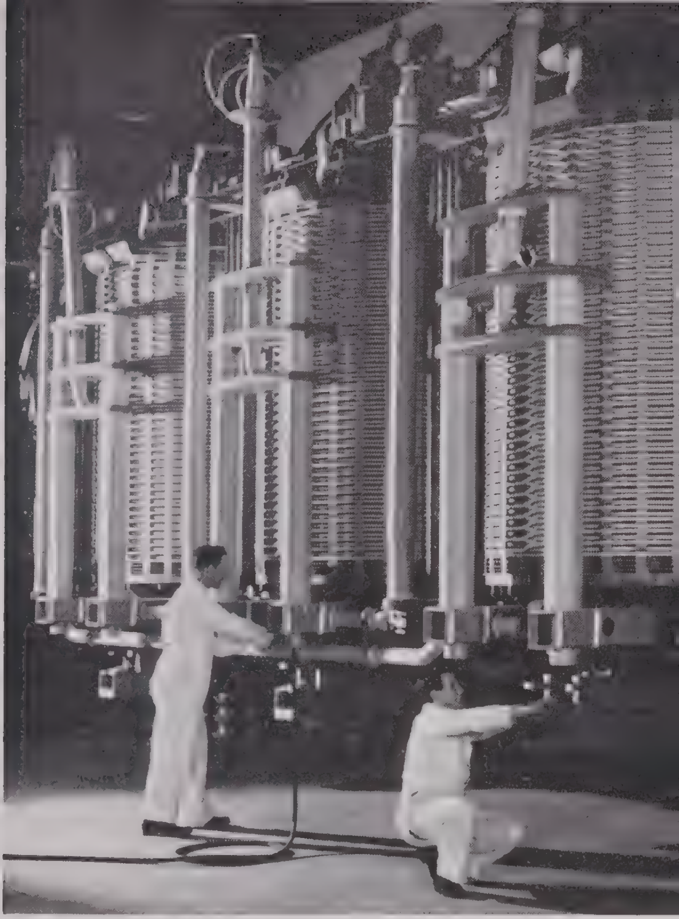
Using a feeler gauge to check the air-gap between the armature and frame of a 3,300 h.p. d.c. motor for driving a colliery winder. (A.E.I.)

Machining the slots on the rotor of a 200 MW alternator for Kincardine power station. (General Electric Co., Ltd.)



Building the stator of the sixth 100 MW waterwheel generator for Kariba at A.E.I., Trafford Park. The 180,000 laminations are being consolidated by hydraulic jacks

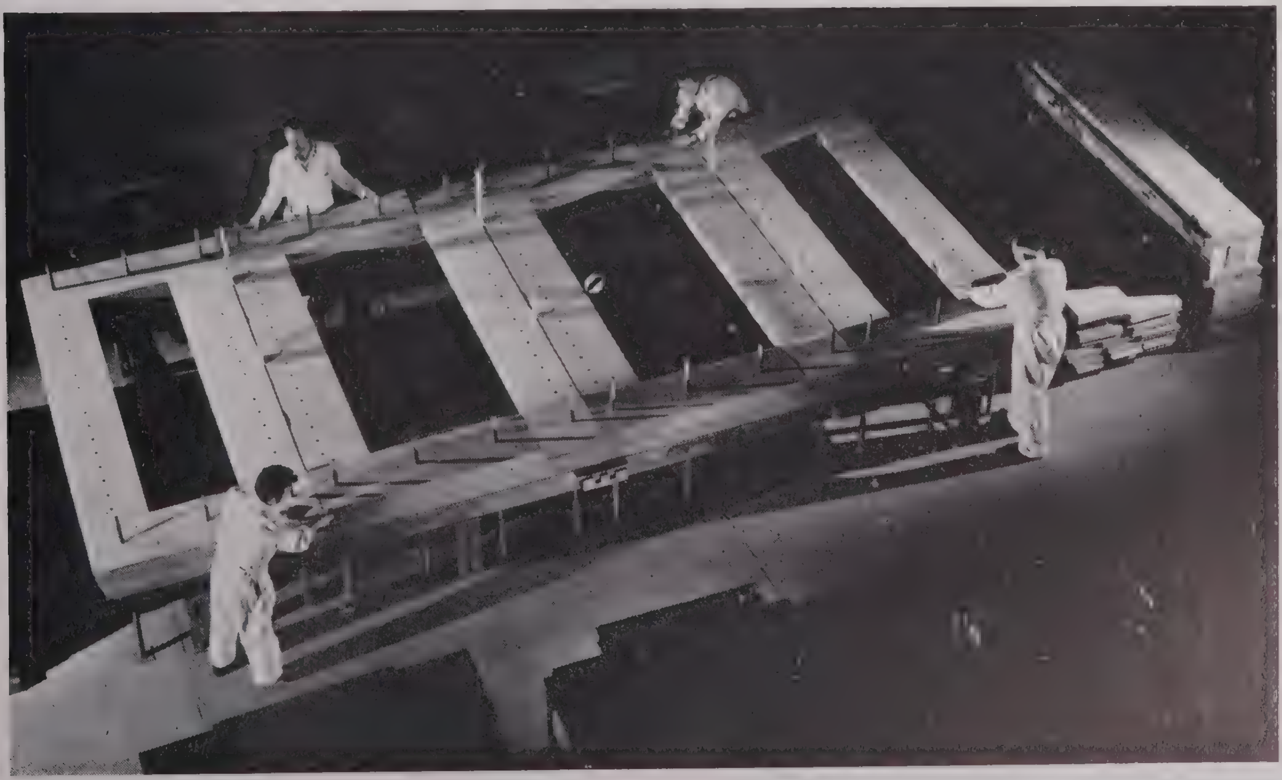




Core and windings assembly for a 210 MVA, 16·2/295 kV generator transformer. The photographs on this page were all taken at the English Electric transformer works, Stafford

A large number of conductors in parallel are wound simultaneously to form a high-voltage disc spiral coil

Building up the five-limb core of a high-voltage transformer using the split-limb type of construction



Final assembly of 11 kV oil circuit-breakers. (South Wales Switchgear, Ltd.)

◀

▲ Assembly of the spin-can and gasket of the Hoovermatic washing machine/spin dryer

◀

The electric motor and fan unit being inserted in the main housing of a Hoover vacuum cleaner

World Trade in Electrical Goods

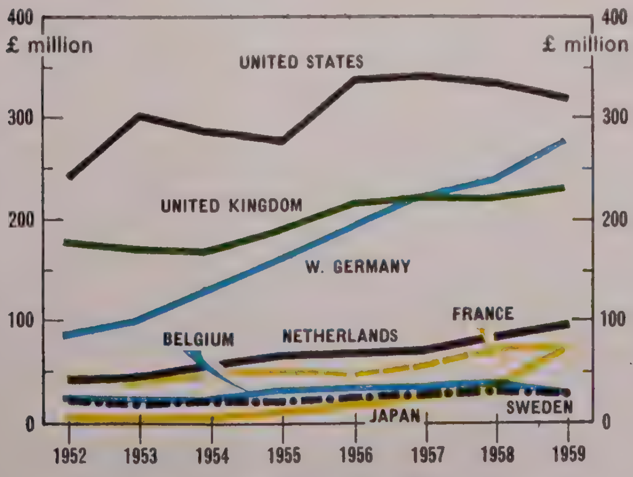
EXPANDING MARKETS IN 1959

This special survey by the Economist Intelligence Unit examines the performances of the main exporting countries and the changing pattern of the rising demand for electrical goods. Japan's success in the United States may lead it to make a determined attack on the European market

IN 1959, for the first time in three years, expansion in economic activity resulted in an increased rate of growth in world electrical exports; these rose by 7·1 per cent compared with 1958, as against the 1958 increase over the previous year of 4·7 per cent. Gratifying though this expansion undoubtedly was, it was only half the increase achieved in 1955 and again in 1956.

The charts accompanying this article illustrate some aspects of world, European and United Kingdom trade in electrical goods. The first (below) shows the value of electrical machinery exported by the leading manufacturing countries. This should not be interpreted too literally, however, as the basis for national statistics varies from country to country. (See also Table 1.)

Once more, there was a fall in United States exports. The American share of the world market declined to less than a quarter, and the continued improvement shown by Western Germany leads to the conclusion that the latter may soon replace the United States as the world's leading exporter of electrical goods. Indeed, as the United States figures are inflated by the inclusion, for "security" reasons, of various other categories under this particular heading, it is possible that in fact Germany may already be in the lead.



LEADING ELECTRICAL EXPORTERS

Perhaps the most significant feature of the 1959 figures is the performance of Japan, which doubled its exports, from £35 million to £71 million, to become the world's sixth largest exporter. Over the last four years Japanese electrical exports have increased by 550 per cent, and in 1959 Japan supplied more than 5 per cent of the world total. Another remarkable increase was that of the Netherlands, which exported electrical goods worth £15 million more than in the previous year: this growth of almost 20 per cent is all the more noteworthy as it was achieved by what is already the largest of the "medium-sized" exporting countries. While the exports of the other leading exporters kept more or less constant, France and Canada each recorded small increases of £3 million, but Belgium's exports fell by £7 million, or 18 per cent of the 1958 total.

The distribution of world trade has once again moved away from the "Big Three." In 1956 the combined exports of the United States, the United Kingdom and Western Germany accounted for 67·5 per cent of total world trade, but in 1957 the percentage fell to 66·1, in 1958 to 62·9 and in 1959 to 61 despite Western Germany's increasing share.

United Kingdom exports of electrical goods (Table 2) are analysed in considerable detail each month in these columns and the figures for 1959 were examined in the issue of 29th January, 1960. Exports of electrical goods in 1959 rose by 3·5 per cent compared with the previous year: on the other hand, total United Kingdom exports rose by 4·6 per cent. In fact, whether the comparison is made with the performance of other countries or with other British industries, the United Kingdom's electrical exports make a poor showing. The United Kingdom's share of world electrical trade has been declining slowly for some years: in 1959 the share of electrical goods in the total of United Kingdom exports also declined slightly.

U.K. and Western Germany Compared

A comparison of British and West German electrical exports by destination in 1956 and 1959 is given in a chart on page 153. During this period the overall total of British electrical exports grew by just under 7 per

TABLE 1.—EXPORTS OF ELECTRICAL MACHINERY AND APPARATUS*
(Value: £ million)

Principal Exporters	1959		1958		1957		1956		1955	
	Value	Percentage of Total	Value	Percentage of Total	Value	Percentage of Total	Value	Percentage of Total	Value	Percentage of Total
United States	320	23·5	335	26·4	342	28·3	339	30·6	276	28·4
Western Germany ...	279	20·5	239	18·9	230	19·0	194	17·4	161	16·5
United Kingdom ...	232	17·0	224	17·6	227	18·8	217	19·5	192	19·7
Netherlands	96	7·1	81	6·4	68	5·7	66	6·0	65	6·7
France	75	5·5	72	5·7	58	4·8	49	4·4	52	5·3
Japan	71	5·2	35	2·8	28	2·3	18	1·6	11	1·1
Belgium	34	2·5	41	3·2	37	3·1	35	3·1	31	3·2
Sweden	30	2·2	31	2·4	28	2·3	26	2·3	22	2·4
Italy	22	1·6	22	1·7	18	1·5	15	1·3	16	1·6
Canada	16	1·1	13	1·0	13	1·1	12	1·1	12	1·2
Austria	14	1·0	13	1·0	11	0·9	9	0·9	7	0·7
Denmark	13	0·9	14	1·1	12	1·0	13	1·2	11	1·1

Source: United Nations. * Standard International Trade Classification 721.

TABLE 2.—U.K. EXPORTS OF ELECTRICAL MACHINERY

	Total (£ million)	Percentage Change on Previous Year	
		U.K.	World
1953 ...	172·6	− 4·4	+ 7·2
1954 ...	170·2	− 1·4	+ 2·4
1955 ...	191·5	+12·5	+14·2
1956 ...	216·8	+13·2	+14·2
1957 ...	227·3	+ 4·8	+ 9·0
1958 ...	223·7	− 1·6	+ 4·7
1959 ...	231·6	+ 3·5	+ 7·1
1960 ...	232*	0·0	n.a.

* Estimated.

cent and the general geographical pattern did not change very much. The biggest change was in exports to the United States, which grew from £9 million in 1956 to £14½ million in 1959, but this gain is unlikely to be maintained as exports to the American market fluctuate fairly considerably, and went down to £8·7 million in 1958. Although there was an increase in exports to the Commonwealth, it was relatively small, and the Commonwealth share of total United Kingdom exports declined.

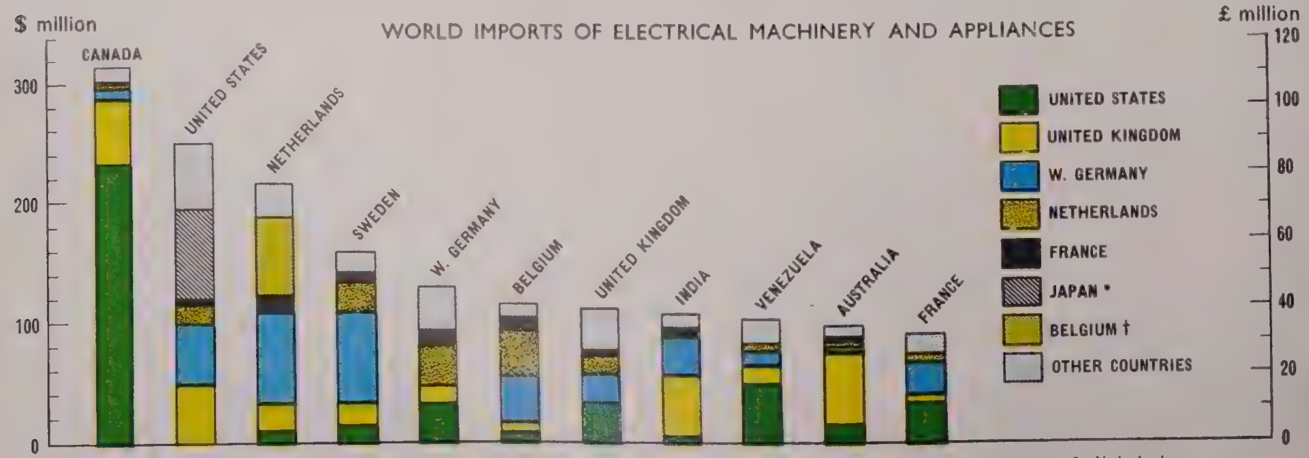
When a rapid expansion in exports is taking place it is quite common for the geographical distribution to change markedly. During the three years under consideration German exports grew by over 30 per cent and with the exception of those to Latin America, which remained constant, there was an increase to each area. The biggest increase in percentage terms was that recorded in shipments to the Commonwealth, which in 1959 accounted for over 11 per cent of German electrical exports. Perhaps the most interesting and disturbing change is in the European markets where the other countries of the European Economic Community (E.E.C.) now account for less than 24 per cent of German exports compared with over 30 per cent three years ago. There is thus a paradoxical situation in Europe, where Germany's exports to the European Free Trade Association (E.F.T.A.) are of more importance to her than those to the E.E.C., whereas with Britain the position is reversed. The most disquieting aspect of these figures from the British point of view is that German expansion is greatest in just those markets where Britain should have the advantage.

Domestic Appliances

Domestic appliances account for over 10 per cent of British exports of electrical goods, but the geographical distribution differs from that of the group as a whole. (See Table 3 and chart on page 153.) The European market is of primary importance to the domestic appliance manufacturers, accounting for nearly 40 per cent of the total export market compared with only 20 per cent of the export market for electrical goods as a whole. The importance of the Commonwealth, the United States and the rest of the world is correspondingly reduced. It is worth noting, however, that the breakdown of the European market for domestic appliances between the E.E.C., the E.F.T.A. and the rest of Europe is very similar to that for electrical exports as a whole. Germany takes over a third of our exports to E.E.C. countries and Belgium a

TABLE 3.—U.K. EXPORTS OF ELECTRICAL MACHINERY AND DOMESTIC APPLIANCES BY DESTINATION, 1959

Destination	Commonwealth	E.E.C.	E.F.T.A.	Rest of Europe	U.S.A.	Rest of World
% all electrical exports ...	57	10	7	3	6	17
% exports of domestic appliances ...	51	20	12	5	4	8


WORLD IMPORTS OF ELECTRICAL MACHINERY AND APPLIANCES

**Imports from Japan are included in "other countries" except for U.S.A. †Imports from Belgium are included in "other countries" except for Netherlands.*

quarter. Italy and the Netherlands both take about a sixth and France the remaining twelfth. Of our exports to the rest of the E.F.T.A., Sweden and Norway each take about a third and Switzerland takes a fifth.

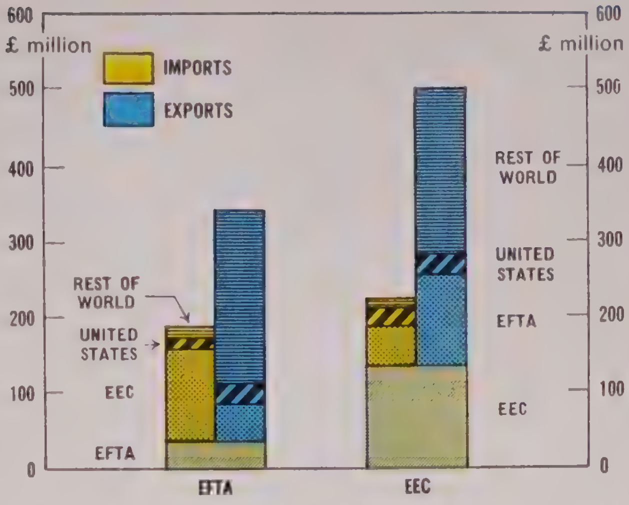
Washing machines account for a third of Britain's domestic appliance exports to Europe and are the most important single item. Europe is also the largest market for British washing machines, taking in all over 70 per cent of total exports.

Next in importance among Britain's domestic appliance exports to Europe are refrigerators, which account for nearly 20 per cent. Most of these refrigerator exports are in the form of equipment and parts rather than complete appliances; the biggest buyers are Italy and Germany, who take nearly half of our refrigerator equipment exports to Europe.

The Commonwealth buys a very high proportion of British exports of cookers, kettles and water heaters, though in this market refrigerators and refrigerating equipment are the biggest items in our domestic appliance export list, accounting for over a third. Exports of fans, complete and in parts, to the Commonwealth are also important and account for nearly 15 per cent. In this connection, however, it must be remembered that the trade statistics are not confined to domestic fans.

European Trade

Since the end of 1959 the building of the tariff barrier between the E.E.C. and the E.F.T.A. has begun. The structure of the trade of each group in electrical goods has therefore been compared (see this page) to show how far the groups are self-sufficient or mutually dependent for electrical equipment. When looking at the chart it should be borne in mind that the dominant member of the E.F.T.A. is the United Kingdom: in the E.E.C., on the other hand, the largest member, Germany, has not such a prominent position. It will be seen from the solid block at the bottom of the chart that there is already a considerable trade between the six members of the E.E.C., in contrast to the smaller amount, both relatively and absolutely, within the E.F.T.A. As there was a net export of goods from the E.E.C. to E.F.T.A. of £70 million, Britain could gain more on the E.F.T.A. swings than she has lost on the E.E.C. roundabout. Yet several factors point the other way. In the first place this gain is a once-for-all possibility due to the redistribution of the existing market: and one must not ignore the fact that the relative potential growth of the E.E.C. market is much greater than that of the E.F.T.A. market. Secondly, there are the inroads which Western Germany has made into what could be described as our "home ground." Finally, as an examination of the chart shows, trade with the E.E.C. is more important to the E.F.T.A. countries than their internal trade—more of the Association's exports are to the Community than to other member countries.



TRADE OF THE "SIX" AND THE "SEVEN"

TABLE 4.—LEADING WORLD IMPORTERS OF ELECTRICAL GOODS

	Imports (£m)		Percentage imports from certain countries															
	1959	1958	Total	U.S.A.		W.G.		U.K.		Netherlands		France		Japan		Others	
Canada	112·2	99·5	100	74	79	3	2	18	14	1	1	*	*	3	1	1	3
United States	89·9	60·2	100	—	—	20	24	19	23	6	6	2	3	30	17	23	27
Netherlands ...	77·0	67·0	100	5	5	34	32	10	14	—	—	7	4	1	1	†43	†44
Sweden	57·0	50·7	100	10	9	47	48	11	11	17	16	4	3	1	*	10	13
W. Germany ...	46·6	36·5	100	23	18	—	—	13	11	26	27	11	14	1	1	26	29
Belgium ...	41·7	38·6	100	9	9	32	33	6	6	34	33	8	8	*	*	11	11
United Kingdom	40·2	29·6	100	28	27	19	20	—	—	16	14	5	4	*	*	32	35
India	37·5	37·3	100	5	8	32	21	50	52	2	3	3	3	4	4	4	9
Venezuela ...	36·8	20·0	100	47	63	15	10	13	11	3	4	2	3	4	3	16	6
Australia ...	34·4	32·3	100	17	16	5	4	61	64	7	6	1	*	2	2	7	8
France	32·5	34·0	100	34	31	27	30	9	10	9	8	—	—	*	*	21	21

* Less than 0·5 per cent. † Belgium: 31 (1959); 32 (1958).

Rising Imports

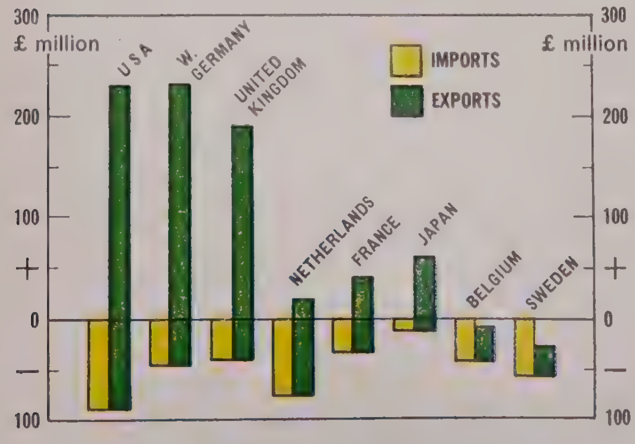
Canada once again proved to be the world's leading importer of electrical goods (Table 4). In 1959 Canada's total purchases rose to over £112 million. The principal suppliers were the United States and the United Kingdom, who between them accounted for over 90 per cent of Canadian imports—the United Kingdom gained most by the growth and increased her share of the market. Imports into the United States have grown rapidly since 1955, and with an increase of nearly 50 per cent during 1959 the United States moved up into second place. The growth of United States imports in recent years has been phenomenal—between 1955, when they were £24 million, and 1959 they nearly quadrupled. Much of this growth was due to increased imports from Japan; in 1955 these were virtually negligible, but by 1959 they accounted for nearly a third of the total. The rapid Japanese expansion of exports, mentioned earlier, has been based primarily on this exploitation of the United States market. Before this large growth took place the leading suppliers of the United States market were the United Kingdom and Western Germany; it is their shares of the market which have been most drastically reduced.

Dutch imports, having remained level in 1958, rose again in 1959—though not as much as those of the United States. In this case also there was a slight shift in the distribution of purchases—the United Kingdom being the main loser, while France and Western Germany both increased their shares. Swedish imports grew considerably—by 12 per cent—but there were no marked changes in the shares of suppliers. Western Germany increased not only exports but also imports; a £10·1 million rise in the latter represented a growth of nearly 30 per cent over 1958. The major fruits of this increase were reaped by the other two members of the " Big Three," the United States and the United Kingdom, both of whom secured a larger share of the market. The French and Dutch shares, on the other hand, both declined. Belgian imports expanded by just over 8 per cent, or slightly more than world trade as a whole. As in Sweden, the division of the market between the leading suppliers remained much the same.

While Britain's exports were expanding slowly in 1959, imports increased by 35 per cent, so that from being the tenth largest importer in 1958 the United Kingdom jumped to seventh place in 1959. This, however, did not result in any startling redistribution of the trade. India presents a striking contrast, for while its import bill remained almost constant, Western Germany's share grew considerably, mainly at the expense of the United Kingdom and the United States.

Venezuela's imports tend to fluctuate considerably from year to year—in 1958 they were low by the standards of recent years—so that it was not surprising to find a big increase in 1959. The pattern of supply changed considerably. Despite an increase in the actual value of its exports to Venezuela, the United States suffered a significant fall in its share of the market. During previous fluctuations, the United States has usually managed to supply well above 50 per cent of the imports, but in 1959 the proportion fell to 47 per cent. The countries which profited most were the United Kingdom and Western Germany—especially the latter.

The other two importers for which figures are given did not record significant changes in 1959. Australian imports expanded slightly less than world trade as a whole, while France's imports declined in value. In Australia the United Kingdom lost ground slightly. In France the United States gained mostly at the expense of Germany; though there was also a slight fall in the United Kingdom's share.



WORLD NET EXPORTERS OF ELECTRICAL GOODS

United States Decline

Looked at from the point of view of the suppliers to the main markets, the general pattern of export trade discussed at the beginning of this article is borne out. The United States' largest customer is Canada and there its market share was reduced. Most of America's other leading customers are in Latin America and there United States exports tended to suffer an absolute decline. With the tendency of these markets to expand, the result was that United States' shares of these markets often fell quite considerably—Venezuela being typical.

Western Germany gained ground in overall world trade during 1959, but this did not represent a general advance in all markets; in several, Germany's share declined, though in all the major markets the actual value of exports increased. In the Netherlands, Germany's second largest market, Germany increased its share as a result of a 12 per cent increase in exports, and in Sweden, Germany's fastest growing, and now largest, customer, its share decreased only slightly.

The United Kingdom's share of world trade, as has been already pointed out, showed a slight decline during 1959. It is not surprising, therefore, to find that in many markets the United Kingdom's share diminished. The only increase was in Canada, and this was at the expense of the United States, whose export performance in 1959 was worse than our own.

The remarkable Japanese growth, as has been mentioned already, was achieved by the great inroads which were made into North America, but how much further such expansion can continue is difficult to tell.

A comparison of leading electrical importers with leading electrical exporters shows that many countries feature prominently in both roles—the United States, for instance, is the largest exporter and the second largest importer; the Netherlands is the world's third largest importer and fourth largest exporter. The net position for the most prominent countries can be seen from the chart on this page. Imports have been set below the line and exports set off against them; thus the net value of exports appears above the line. In the case of Belgium and Sweden imports are greater than exports and the extent to which they are net importers is measurable by the extent to which the export total fails to reach the line. The strength of the German industry can readily be seen, and the chart also brings out clearly how much the electrical industry is to Japan an " export " industry.

Future Prospects

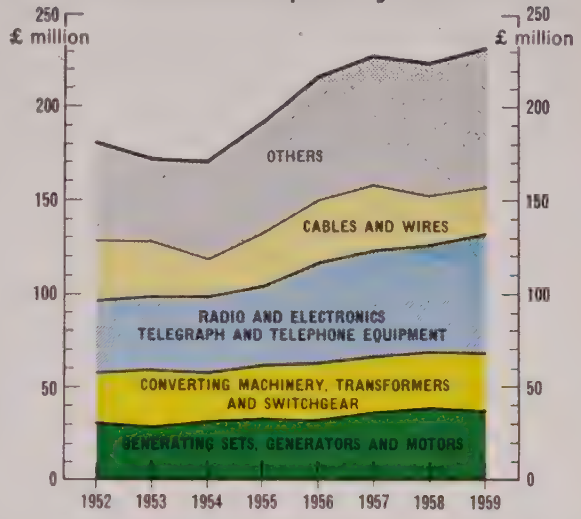
It is clear that the general pattern of world trade is changing gradually, though one must beware of reading too much into two years' comparisons. The picture in Europe will obviously change considerably over the next few years and political considerations between the E.F.T.A. and the E.E.C. may well determine the future trading pattern. The United States are losing ground in their traditional markets, and the full impact of Japanese competition has yet to be seen. At some stage Japan will probably make a determined attack upon the European market and this could have more far-reaching effects even than the existence of the " Six " and the " Seven."

U.K. ELECTRICAL EXPORTS

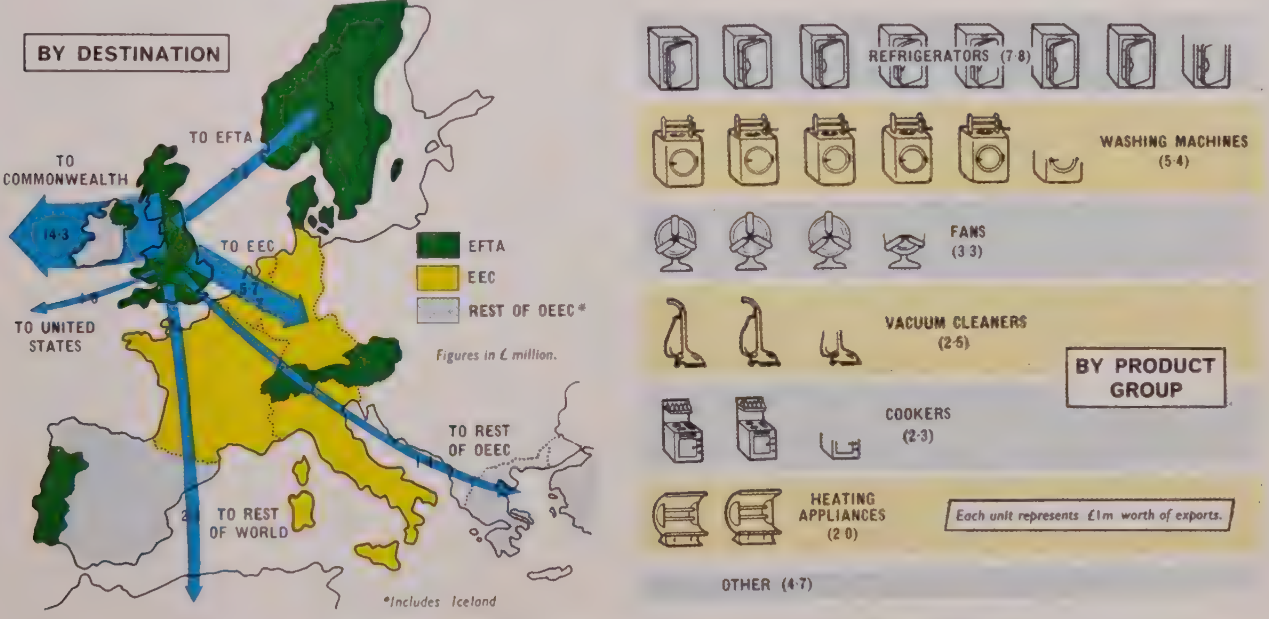
ELECTRICAL EXPORTS play an important part in the United Kingdom's overseas trade, and the 1959 total of £232 million represented 7 per cent of all exports. This proportion has remained fairly constant in recent years. The way in which the various sectors have contributed to the total since 1952 can be seen from the chart on the right. In 1955 some 16 per cent of all the electrical goods produced in this country were exported, and the present proportion is much about the same although it rose to 18 per cent in 1957. By contrast, the proportion of output exported by the engineering industry in 1959 was 27 per cent; by the vehicle industry it was 20 per cent and by the chemical industry 16 per cent.

In West Germany, the ratio of exports to production in 1959 was 22·6 per cent compared with 21·7 per cent in the previous year. The main areas to which British and German exports were sent in 1959, compared with 1956, are shown in the lower chart, while the centre diagram illustrates United Kingdom trade in domestic appliances.

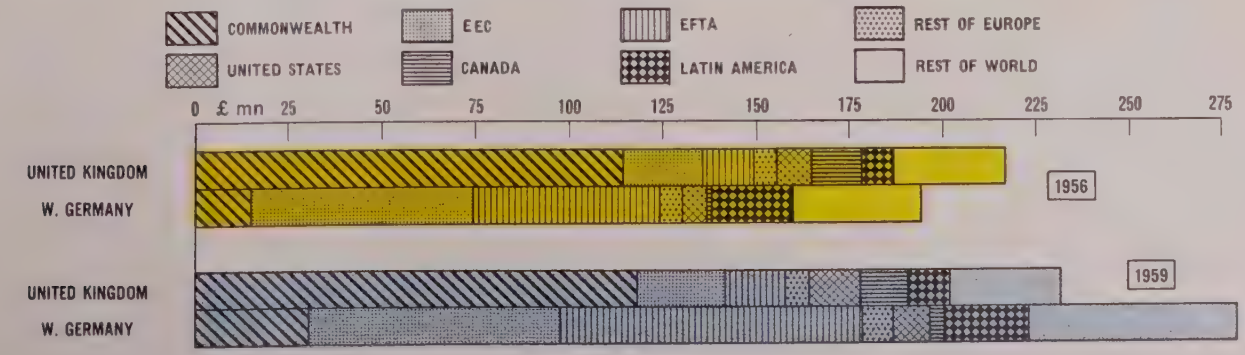
UK Electrical Exports by Product



UK Exports of Domestic Appliances 1959



UK and West German Exports by Destination 1956 and 1959



PRODUCTION and

AN ECONOMIC SURVEY OF THE ELECTRICAL INDUSTRY IN 1960

WRITING twelve months ago it was possible to look back on a period during which the movement towards expansion in the economy which started in the autumn of 1958 gathered momentum and spread gradually to most sections of industry. For most of the year the pace was set by domestic appliances and there was some anxiety at the slowness with which the boom was working through to the heavy engineering and capital goods sides. But by the end of the year expansion was almost universal and in fact there was already some concern at the inflationary pressures that might arise if the output of consumer goods and capital equipment continued their upward trend simultaneously.

During 1959 sales and work done by the electrical engineering industry were valued at £1,462·9 million or 6·5 per cent of the total for all manufacturing industry. Total stocks and work in progress increased by 37·5 per cent during the year. Capital expenditure is estimated at £56·7 million, slightly more than in 1958. The index of production for the electrical industry shows a rise of 13 per cent between 1958 and 1959, compared with nearly 7 per cent for all industry. But, whereas the output of heavy plant and cables rose only marginally, domestic appliances rose by 40 per cent.

Uncertainty

The picture revealed by an analysis at the end of 1960 is one of considerable uncertainty and many conflicting considerations. It has been summed up succinctly in the *Treasury Bulletin for Industry* in these words:—

" Total industrial output has levelled with increases and decreases cancelling out. The pressure of demand for labour has not eased. The growth of inflationary pressure has been checked, but the trend in costs is upward and the external position is not satisfactory."

The main point of uncertainty was in the external position and measures to alleviate difficulties at home were postponed by the Government because they might have aggravated an external position that was getting worse rather than better. The deterioration in our balance of payments situation, which was masked by the inflow of short-term funds in search of high interest rates, was due to a continued rise in imports and a fall in exports below the first quarter peak. The steep rise in imports was to some extent due to the rapidity with which national income and expenditure grew in 1959. Traders and manufacturers were raising stocks over a wide field to bring them into line with the larger flow of goods. By the end of the year there were signs that this process was complete, so that imports should fall to the current level of usage. In some cases, for example steel and refrigerators, large imports were the result of plans made or orders placed in 1959 when a marked shortage was expected in 1960.

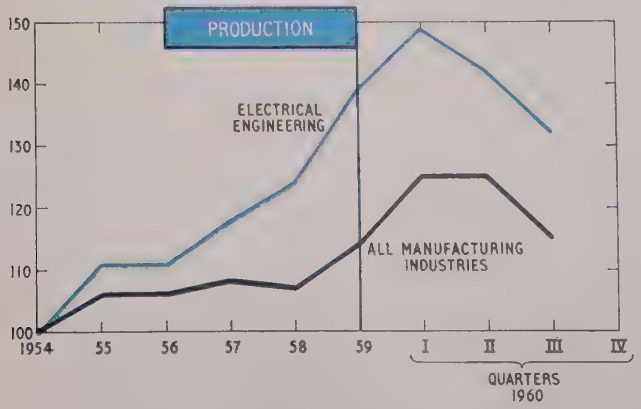


Fig. 1.—The output of electrical manufacturers has expanded faster than that of manufacturers generally

Between the first half of 1959 and the first half of 1960, the volume of imports of industrial materials rose twice as much as production, 22 per cent compared with 10 per cent. Alongside this development there was a substantial increase in stocks and work in progress. In the first quarter it was £160 million compared with £10 million a year earlier (1954 prices). There has been a substantial rise in recent years in the import content of domestic capital expenditure on plant and machinery. Whereas gross fixed capital investment in plant and machinery at home rose by just over 40 per cent between 1954 and 1959, imports of industrial machinery, mainly capital equipment, went up three times as fast.

Output Increases

Industrial production in the United Kingdom appears to have been expanding for, at the most, eighteen months —from the fourth quarter of 1958 to the second quarter of 1960. It had nearly levelled out by the end of the second quarter and in the subsequent four months to October the index of production (seasonally adjusted) remained at the same level. If there was no increase in the last two months of the year, the index will have been only three per cent higher than in the fourth quarter of 1959.

The index of production in the electrical industry does not yet go beyond the third quarter and since it is not seasonally adjusted it shows a further but expected decline during the holiday period (Fig. 1). Though output fell from the peak achieved in the fourth quarter of 1959, in the first three quarters of last year it was 7·5 per cent higher than in the corresponding period of 1959. As can be seen from Fig. 2 advances were made in all the main groups of electrical products except domestic appliances. However, the official figure does not include refrigerators and if these are added it will be found that output in this sector was marginally up on the first three months of 1959. (The refrigerator figures include about 10 per cent of non-electric refrigerators.)

Domestic Appliances

The much publicised difficulties of the domestic appliance side of the industry have been due to the fall in demand and production from the very high levels achieved

MPLOYMENT

e rapid expansion of the British economy
ring 1959 levelled out last year. The fall in
port demand and in the sales of cars and
mestic appliances was offset by rising invest-
ent and production in the engineering indus-
es. In general, the changes have been small in 1959, and though output is below manufacturers' expanded capacity it is still high by historical standards. In the third quarter there was actually a small increase in the total excluding refrigerators.

The new statistics which the British Electrical and Allied Manufacturers' Association have been collecting have enabled a more accurate picture to be obtained of the progress of separate appliances. In fact, the figures have now been collected for long enough for a direct comparison to be made between the third quarters of 1959 and 1960. Too much should not be deduced from the results at this stage since comparison is being made between a period when output was being expanded unnaturally fast, following the lifting of all credit restrictions, with a period when demand was limited by the partial re-imposition of the controls and other factors. For manufacturers the position was aggravated by the accumulation of stocks and the continuing high level of imports.

Large Stocks

At the end of November retailers' and wholesalers' stocks of refrigerators were estimated at 500,000. The slow movement of appliances through the shops led to some price cutting by retailers and more recently to price reductions by manufacturers. But, in general, manufacturers seem to have been slow to respond to the changed picture and price reductions earlier in the year might have had more impact than in the autumn when some relaxation in credit restrictions was expected.

A more serious effect of the build-up of stocks is the brake it puts on the introduction of new models which, if showing some real advance in design, would probably do more to stimulate sales than small reductions in price. It is, for example, interesting to note how over the past eighteen months the combined washing machine and spin dryer has gained at the expense of the washing machine fitted with a wringer. There have been indications in recent months of an advance in the sales of the fully automatic models and it is possible that a wider selection of such designs might have offset to a greater extent the decline in total sales. By November, exports of combined washing machines and spin dryers were 60 per cent higher than a year earlier, but since these exports form only a fifth of total production they are insufficient to compensate for the fluctuations in home demand.

Manufacturers' deliveries of those appliances which, because of price, require only a small deposit and of cookers, on which the regulations do not bear so severely, showed a steady advance. Compared with the corresponding period of 1959 manufacturers' deliveries of

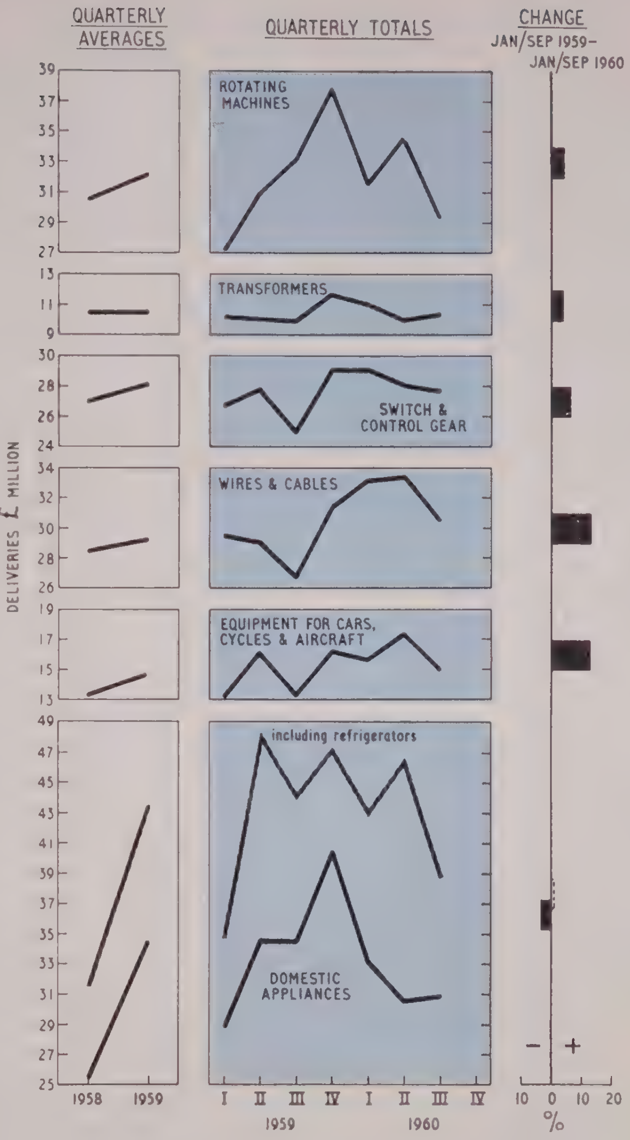


Fig. 2.—Manufacturers' deliveries of electrical equipment and appliances

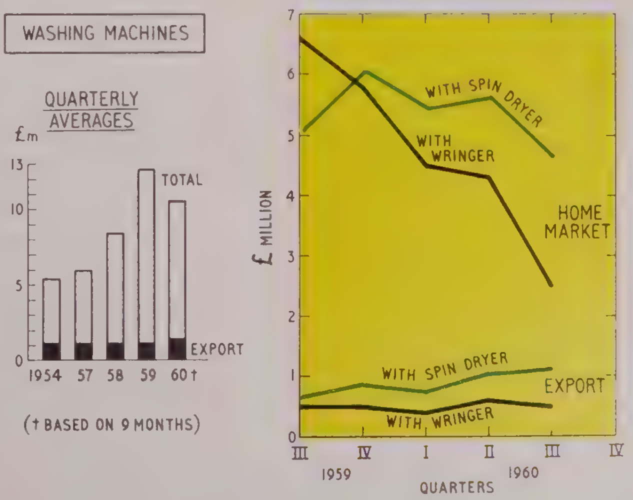


Fig. 3.—Comparison of the production and exports of the two main types of washing machine

cookers in the third quarter of last year were up by 19 per cent; deliveries of space heaters were up by 29 per cent; electric blankets by 47 per cent; and deliveries of food and drink mixers by 24 per cent. Sales of electric cookers are now approaching those of gas—in September the respective figures were 48,200 and 51,300.

Imports of domestic appliances expanded by 58 per cent during 1959 and the total for the first nine months of last year was still 20 per cent higher than the record level a year earlier and over three times that of the corresponding period of 1958. There was, however, a sharp falling off in the third quarter of last year when imports were only £2·4 million compared with around £4 million in each of the first two quarters. Though imports of washing machines were much lower than in the first nine months of 1959, imports of refrigerators rose by over 70 per cent.

Sales of appliances are not recorded on any comparable basis to the production statistics, but figures issued by the Electricity Council of sales by Area Boards give an indication of the trends in the larger appliances. The latest figures show that during the twelve months ended October, 1960, there was an increase over the previous twelve months in the sales of cookers and storage water heaters, but that sales of washing machines dropped by 30·5 per cent, and refrigerators by 16·8 per cent. However, the sales of these two appliances were still 75 per cent and 45 per cent above the level achieved in the twelve months to October, 1958.

The credit restrictions not only impinge most severely on a few appliances but on the fastest growing section of the market. Over the past two years sales to working class homes of vacuum cleaners, washing machines, TV sets and refrigerators have been rising more rapidly than those to other social classes. Total ownership of these appliances, with 1958 figures in brackets, is now estimated as vacuum cleaners 72 per cent (65 per cent); washing machines 40 per cent (28 per cent); TV sets 75 per cent (62 per cent); and refrigerators 25 per cent (13 per cent).

Demand for these four appliances together rose rather more than 15 per cent a year on average in the 1950's. An analysis,* based on certain assumptions about the appliances' length of life and about saturation levels, suggests that in the 1960's demand is not likely to rise faster than 2½ to 5 per cent a year. It appears, from capacity figures, that manufacturers, as a whole, have been too optimistic about the future trend of demand (though in some instances the introduction of very much cheaper machines could alter the picture). Analysis of past short-term fluctuations suggests that a reduction in prices of 10 per cent could lead to a 10 to 20 per cent once-for-all rise in demand; but the removal of the present hire-purchase restrictions would have only a mild effect.

Employment and Costs

Employment continued to rise in all sections of the electrical industry and the total last September was 5 per cent higher than a year earlier. In general, slackening output has been reflected not in less employment but in shorter hours. The pressure of demand for labour has not changed markedly and during most of the year vacancies exceeded unemployment.

Costs and prices were generally stable and falling during 1959. Costs last year were increasing, though the index of prices of domestic appliances moved downward very slightly against the general trend. Labour costs rose quite steeply—further wage awards are pending—and the levelling out of output stopped the rise in productivity which previously offset the rise in labour costs. Company profits, which had been rising steeply, levelled off and were unchanged between the first and second quarters of 1960. Though some manufacturers of the larger appliances were experiencing difficulties, and short-time working was introduced in the summer and autumn, other firms reported that business was expanding. To judge from statements by chairmen of firms making equipment for industry, activity was continuing at a high level though not increasing at the previous rate. There might be difficulty in maintaining profits, but the future was regarded with cautious optimism. Nevertheless, the more competitive conditions have been revealing some points of weakness in individual firms.

Expanding Investment

The public investment programme, the forecasts by private industry of its investment plans and the rising trend of production and the state of order books in the capital goods industries all point to a steady upward trend for the second half of 1960 and well into 1961. The new public investment programme envisages an increase of about £60 million or 4 per cent in 1961-62 compared with the anticipated actual rate of expenditure in 1960-61. There are big increases in construction work and investment by the electricity supply industry goes up from £327 million to £358 million. On the other hand, expenditure on railway modernisation is being slowed down.

Manufacturers stepped up their capital expenditure considerably in the third quarter, much more than is usual in these months. Allowing for seasonal factors there was an increase on the previous quarter of 14 per cent. Spending on plant and machinery was up by 27 per cent on the same period of 1959. In the summer, industry expected that it would be investing 20 per cent more last year than in 1959 and that it would increase its investment still more in 1961. Recent indications are that private industry's plans for expanding investment have not been affected by the credit restrictions.

A more sensitive pointer to both changes in demand and the extent to which demand is being met is the changes in the state of companies' order books. The Board of Trade are now publishing a series which covers engineering and electrical goods, separately, and also together with railway goods, heavy commercial vehicles and wheeled tractors. The larger group covers industries accounting for about 20 per cent of the index of industrial production. The series has not been running for long and it requires cautious interpretation. Sharp changes in the rate at which orders are received do not necessarily imply similar sharp changes in production; rises may lead to larger order books and lengthening delivery dates, and falls to an increase in stocks and shortening delivery dates.

New orders received in the third quarter of 1960 were at a somewhat higher rate than in the second quarter and well above a year earlier, though less than the particularly vigorous inflow in the first quarter. With deliveries falling seasonally in the holiday months, the gap between net new orders and deliveries widened and orders on hand, mainly for capital goods, increased substantially. At end-September the volume of orders on hand was 5 per cent more than at end-June; in the second quarter they had increased by 2 per cent and in the first by 8 per cent. Export orders on hand were increasing at a lower rate in the third quarter than home market orders.

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* *National Institute Economic Review*, November, 1960.

In the long term it is possible to take an optimistic view of the prospects of the electrical manufacturing industry. There is a close relationship between the consumption of electric power and economic growth. And the aspirations of many developing countries towards industrialisation and better living standards are bound to produce a constant and expanding demand for electrical goods. At the same time trade between the industrialised countries of Western Europe and the United States is likely to continue at a high level even if growing less rapidly than in recent years.

But the fortunes of the British electrical industry cannot be isolated from the prospects for the economy as a whole. Here the main danger is still insufficient export earnings. Less buoyant world demand and the tendency for costs and prices to increase make the task of increasing exports more difficult. An important requirement in increasing efficiency and export performance is that there should be heavy and continuing investment by manufacturing industry and public services. A relaxation and stabilisation of the credit restrictions might act as a useful incentive. The best way of improving the United Kingdom's export earnings is the promotion of continuing growth in the economy and hurried measures to deal with balance-of-payments difficulties should not be allowed to jeopardise this.—R.F.M.

Training Overseas Engineers

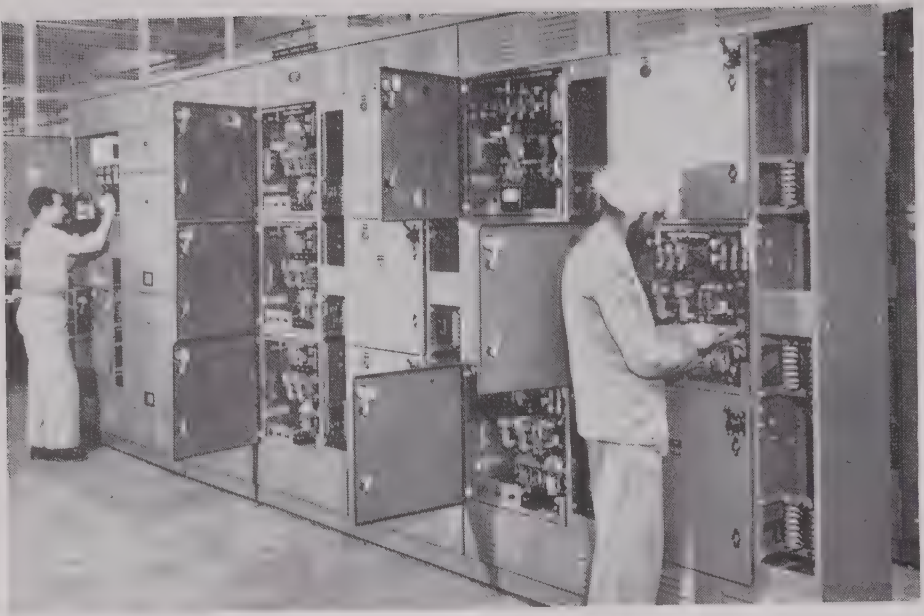
By J. E. HOLDEN, B.Sc., A.M.I.E.E.

Many hundreds of engineers from overseas are at present undergoing training in the factories of British electrical manufacturers. Mr. Holden, of the education and personnel services of the General Electric Co., Ltd., describes how courses have been arranged to meet the different requirements of graduates, experienced engineers and technicians. The wider benefits of a visit to this country are also noted

For many years the manufacturers of electrical engineering equipment in Great Britain have accepted annually some hundreds of young engineers from overseas for training in their experimental, design and manufacturing establishments. At present 1,000 or more are accommodated annually and the number is increasing. They are taken for a variety of reasons. First, because many manufacturers have their own overseas organisations which they require to staff with nationals of the various countries in which their branches or works are situated. Second, it is clearly valuable to provide training for the staff of overseas customers who purchase their equipment. Third, and this accounts for the greatest numbers, because they believe that in the long run their own prosperity depends on industrial development overseas.

Many of the large manufacturers have their own well-established overseas training schemes. Their overseas representatives, who are to be found in most countries of the world, are in a position to act as agents in recruitment by maintaining close liaison with the universities and colleges, as well as with industry, in their territories. In addition, there are a number of scholarship schemes embracing the engineering industry as a whole, which are run by Government Departments and by such organisations as the Federation of British Industries. In these the electrical manufacturers play a leading part. The F.B.I. offers scholarships, which, financially, are comparable to those of individual firms, especially to young engineers from the countries of the Commonwealth, Latin America, the Middle and Far East and Europe. Government-sponsored schemes include Athlone Fellowships, administered by the Board of Trade, which offer facilities to young men from Canada for both industrial experience and advanced academic study or research in Britain. Other important opportunities are made available through the British Council who administer, for example, the Colombo Plan Technical Co-operation Scheme. Whilst these bodies are responsible for the administrative side of their various training plans, they must place trainees who require industrial experience in electrical engineering with the various electrical manufacturers, upon whom inevitably devolves the final responsibility for providing the required training, as well as much of the cost of their maintenance.

Through whichever scheme they come, overseas trainees fall, broadly speaking, into three categories: those, who, having graduated in engineering or applied science, require complementary industrial training; more mature engineers who have already had some years of professional experience; and engineers and technicians who need knowledge of the equipment being supplied for a particular contract.



Indian trainees in the G.E.C.'s Witton works, Birmingham, assembling a motor control centre for Durgapur Steelworks

Many countries, for example Australia and New Zealand, have very sound university schools of engineering in which their young engineers may qualify theoretically by taking a first degree or, in some cases, a higher qualification. Very often, however, the practical and professional experience, which is the counterpart of academic study, that is available locally is limited. It may be confined almost entirely to the operation and maintenance of electrical equipment, with little opportunity to see at first hand its manufacture and test, or to gain insight into the methods by which it is developed and designed. Other young men from all parts of the world complete their academic studies at universities or colleges in the United Kingdom with the intention of returning home after obtaining industrial training also in this country.

For such graduates, the British electrical industry provides training courses, usually of two years' duration, which are the counterpart of the post-graduate apprenticeship which is commonly undertaken by British university students in electrical engineering. There are, however, two respects in which the overseas graduate is often in a rather different position from the home graduate. He is usually more likely to be concerned in his future career with system planning and development, or with the installation, operation and maintenance of plant, and only rarely will he be required to take responsibility for research, design or production. Within the functions which he embraces, however, he may be less able than an engineer in England to rely on skilled supporting staff, and he therefore needs sufficient detailed technological knowledge to be able to train others. Secondly, he may not be especially concerned about meeting the training requirements of the Institution of Electrical Engineers, and his programme can be designed without the need to bear these fully in mind.

Typical Course for Graduates

It is obviously a very great advantage if the graduate trainee has a realistic appreciation of the openings that are likely to be available to him on his return to his own country, and the more precisely he can define his objective for future employment the easier it is to draw up for him a programme that will make his training relevant and purposeful. Experience shows, however, that a course along the following lines proves suitable for most overseas graduates: initial manufacturing experience with emphasis on getting to know basic items of equipment in sufficient detail to be able to deal with maintenance and repair; test experience to give insight into technical performance, initial adjustments and safety measures; erection of new plant and equipment on site, followed where possible by commissioning; attachment to a concern which operates the type of plant in which he is especially interested such as the Post Office, Central Electricity Generating Board or British Railways; a period in a design department or contract department with emphasis on the design and specification of equipment for complete installations rather than on the detailed design of individual items.

Overseas graduates who come direct to individual firms are usually paid on the same basis as British post-graduate trainees, for whom rates at present are about £600 to £750 per annum. In many cases their return fares from their home country may be paid, as well as an allowance of about £50 per annum during their two years of training to enable them to purchase any special clothing they may need and to undertake a reasonable amount of travel in the British Isles. Remuneration under the F.B.I. and other scholarship schemes is rather less, but payments are not subject to deduction of income tax as they are in the schemes of individual firms.

Experienced Engineers

Many engineers, having obtained their initial theoretical study and training locally, enter employment in their profession in their own country. After some years in practice, at the age of about 28, they may well have obtained positions of some seniority and have been made responsible for quite major decisions in the organisation in which they are employed, possibly involving the specification of major items of plant or equipment. They may find it a great advantage at this stage to spend a period with a manufacturing firm so that they can bring themselves up to date on the latest developments in the field of electrical engineering with which they are concerned, and at the same time have the opportunity of filling in any gaps in their earlier professional training.

For such engineers who can obtain leave of absence, British electrical firms arrange individually planned programmes, designed to suit the individual background and interests of the man concerned. Six to twelve months is usually a suitable duration. The type of programme which often proves satisfactory may include a short initial period on the assembly and test of the equipment in which the trainee is interested, to make him familiar with the types in current manufacture; a period in the design department and development laboratories to give insight into forthcoming developments and improvements; attachment to British concerns operating similar equipment; and a final period on system design or planning.

Some of the Government and other scholarship schemes make formal provision for engineers with this background. Individual firms will usually make separate arrangements with each applicant about the financial basis on which he can be accepted.

It should be mentioned under this heading, too, that the academic staff of the electrical engineering departments of universities and colleges overseas often find it profitable to spend a sabbatical year in the United Kingdom. Electrical firms are frequently able to provide the opportunities they desire to bring themselves up to date in the latest developments and techniques of their subject, by placing them in the appropriate section of research and development laboratories.

Technical Training for Specific Contracts

It is common practice when major items of electrical equipment are being supplied to overseas territories, especially where there is little engineering tradition and therefore few trained technical people available to operate and maintain it, for members of the staff of the customer to be sent to the manufacturer's works for training. Such trainees are, of course, welcomed, as it is clearly in the manufacturer's interest to see that qualified people are available to ensure trouble-free working of his equipment.

An important current example is the training of the electrical maintenance engineers for the vast new steel plant for the Indian Government at Durgapur, the equipment for which has been supplied through Colombo Plan aid. Some 55 engineers and technicians have so far received training in the works of the electrical engineering firms who have supplied the electrical plant, their course having been phased as far as possible to allow them to work on the equipment for Durgapur as it passed through the manufacturing shops and test departments.

Similar arrangements, though on a rather smaller scale, are frequently made with the post and telegraphs departments of overseas countries to train selected members of their technical staff on new exchange or transmission equipment. The financial terms in such cases are, of course, made direct between the customer and the manufacturing firm.

It may be mentioned in conclusion that the benefits of industrial training in this country are not only technological. Most men from overseas greatly value the opportunities provided by residence here to see the British countryside and to visit some of our historic towns and buildings. Our tradition and the way of life of our people are matters of the greatest interest to them. Trainees are given every help and encouragement by the concerns with whom they are training, to take a full part in the social life of the works or laboratory, and of the town in which they are placed. Few return to their own land without having established lasting friendships over here, as well as having added to their competence as engineers.

CO-OPERATION IN ELECTRICAL EXPORTS

A MEETING in London last week of over 130 export managers and senior executives in the electrical industry —with exports already approaching nearly £300 million— welcomed the suggestion that their trade association, the British Electrical and Allied Manufacturers' Association, should make immediate arrangements to put firms in touch with makers of complementary equipment with a view to joint sales efforts, joint market research and collective exhibitions overseas.

The first step will be the completion of a confidential questionnaire by each of the firms represented—ranging from the smallest electric switch to the largest power station plant—which will enable the Association to bring together firms wishing to co-operate in export promotion. In replying to the questionnaire, the firms will give details of the products they wish to export, the overseas territories in which they would like to co-operate, any existing overseas facilities they would be prepared to share and whether they would like to co-operate with firms in other industries.

Representatives at the meeting drew attention to the many advantages of pooling resources in the most competitive markets, bearing in mind the high cost of maintaining fully trained and experienced sales engineers abroad. There was also a suggestion of sending to overseas territories, including Russia and Eastern Europe, small teams representing groups of manufacturers. Several of the largest firms in the electrical industry offered to provide help to smaller firms manufacturing complementary products, by sharing their overseas facilities.

Among the advantages of co-operation, the B.E.A.M.A. point out, are that manufacturers might find it easier to obtain good agents if these were offered a larger range of goods to handle. Staff travelling from the United Kingdom could specialise in certain territories and languages and the cost to individual firms of maintaining highly qualified representatives abroad would be less. It might also be possible to reduce overheads by sharing overseas manufacturing facilities or storage accommodation. Another suggestion was that groups of electrical firms should set up their own joint export organisations to appoint and supervise agents.

There are also obvious advantages in sharing the heavy expense of participation in overseas exhibitions, especially where goods require demonstrating.

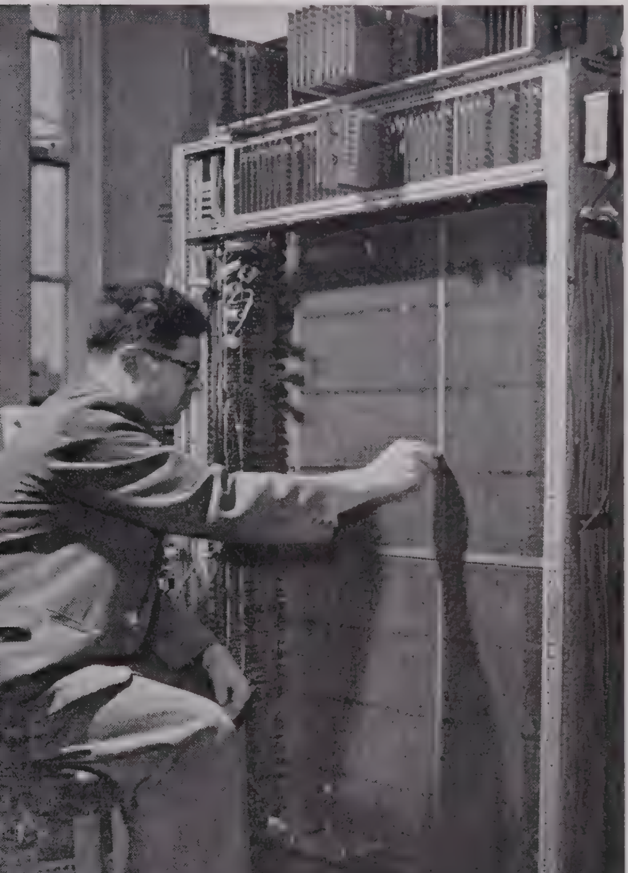
The electrostatic method is used by Electrolux for applying both the priming coat and the final enamel to refrigerator cabinets and doors. The components are carried on conveyors past sets of heads charged at about 100 kV

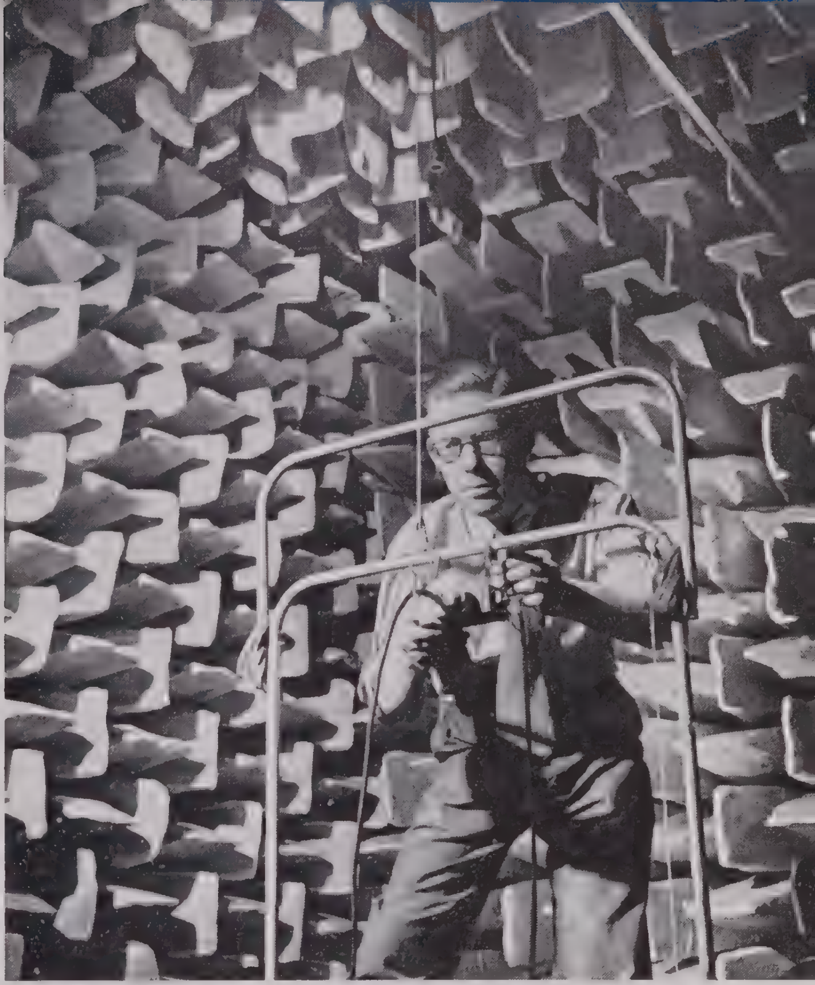
In this automatic spray plant at the Atlas lighting fittings factory enamel is thrown centrifugally from the rotating disc and is deposited electrostatically on to the fittings as they are carried through on a conveyor

A multiple purpose desk for testing the characteristics of receiving valves in the G.E.C. Research Laboratories

BACKGROUND TO EXPORTS

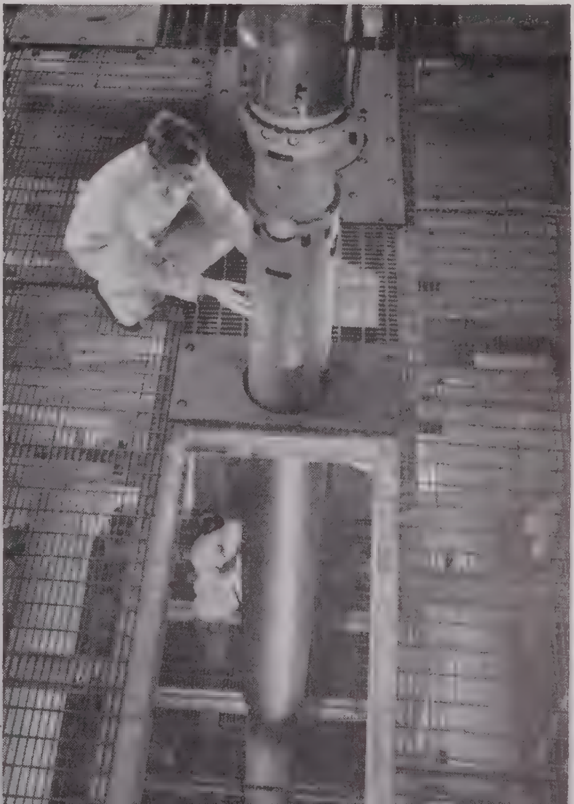
The Ferranti "Atlas" computer under development at Manchester University has a novel type of store for permanent information. It consists of many hundreds of ferrite rods, one of which is shown being inserted, arranged in a mesh of wires



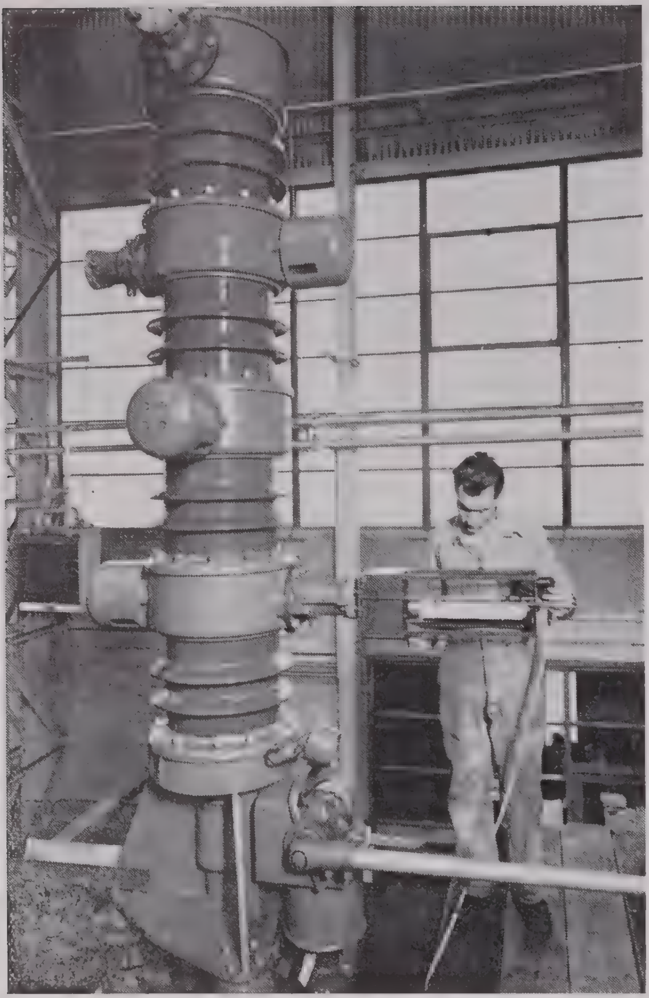


Adjusting the microphone in the echo-less room at the G.E.C. Research Laboratories used for testing the noise level of apparatus such as vacuum cleaners, refrigerators, fluorescent lamp chokes and loudspeakers

At the headquarters of their Atomic Power Division at Whetstone, English Electric have installed test beds for full-scale investigation of the behaviour of nuclear reactor equipment under operating conditions. At temperatures up to 700 F and pressures of 200 lb per square inch the equipment is subjected to severe, continuous running tests lasting in some cases for 500 hours or more. After one such test a control-rod winding mechanism is being raised for examination from a concrete lined test pit 90ft deep

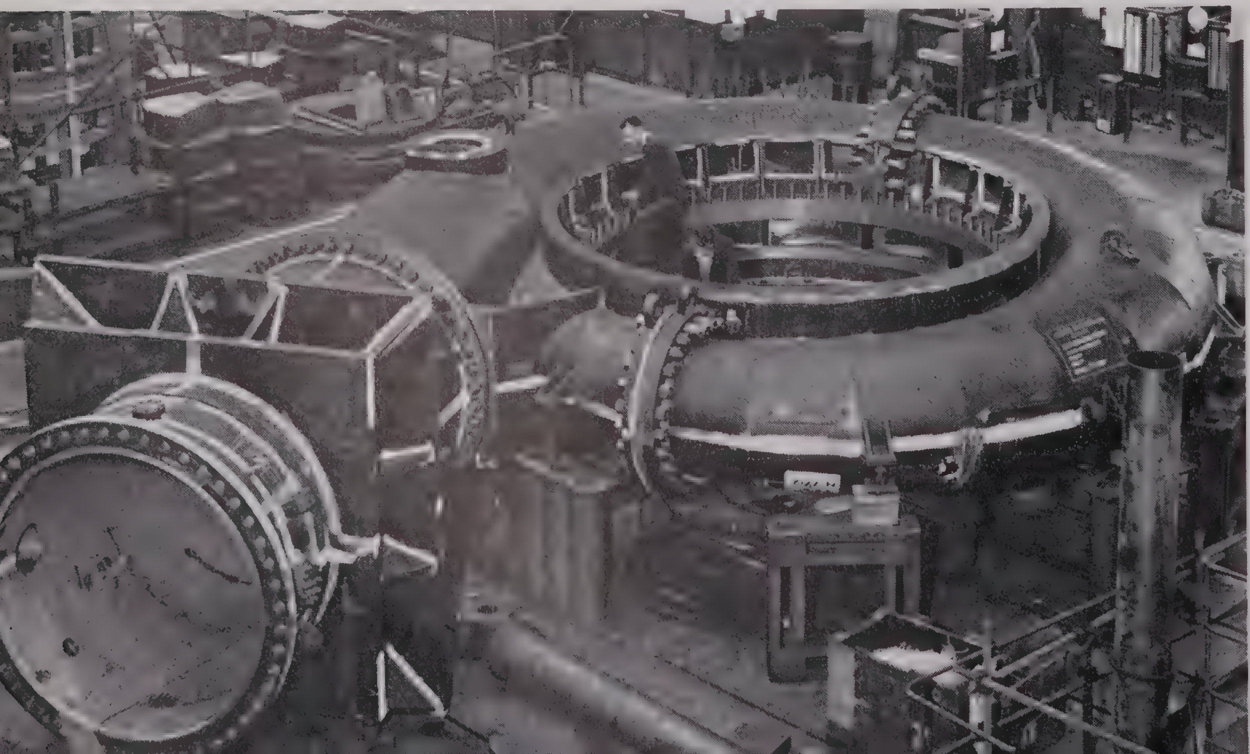


BACKGROUND TO EXPORTS



A Reyrolle 380 kV air-blast circuit-breaker being prepared for test in the impulse laboratory

Blaenau Ffestiniog pumped storage scheme: the motor spider being fitted to the shaft (prior to machining) of one of the 78·9 MVA generator/104,000 h.p. motors being supplied by A.E.I; the spiral casing and inlet pipe being prepared for test at the English Electric Netherton works



Digital Computers for Network Analysis

Summary of two papers which were read before a meeting of the Supply Section of the Institution of Electrical Engineers last week. The first paper, by M. N. John, B.Sc., A.M.I.E.E., was entitled " A General Method of Digital Network Analysis particularly suitable for use with Low-Speed Computers." The other paper, "Digital Computers in Power System Analysis," was prepared by P. P. Gupta, Ph.D., B.Sc., Graduate I.E.E., and Professor M. W. Humphrey Davies, M.Sc., M.I.E.E.

POWER systems engineers have long used the network analyser, in one of its forms, for the analysis of complex power network problems, most commonly for the routine study of balanced load flow and short-circuit conditions. In doing so, they enjoy that intangible " feel of the problem " which arises from the direct correspondence of system and model controls and parameters inherent in analogue representation. There will often, however, be circumstances in which this feature alone is not sufficient to justify the installation of the special-purpose analyser rather than the general-purpose digital computer, e.g. when the solution of network problems occurs as only part of the work of a group requiring other forms of computational assistance or perhaps in academic institutions. Even if access to an analyser is available, digital methods may be preferred for problems which are difficult or tedious in normal analyser practice such as the effects of phase-shifting transformers or voltage regulators.

General Method

For these reasons, it is to be expected that the use of digital methods in this field will increase. Published information to date indicates that this is so, but that major effort has been directed towards the preparation of programmes for large, high-speed computers which are often hired to carry out studies on a piecemeal basis. In many such cases, the indiscriminate use of numerical methods to achieve speed can often result in the systems engineer acquiring insufficient insight into his problems. Mr. John's previous experience in the solution of power network problems had been with the aid of a network analyser and his approach to the development of a digital method was that every effort should be made to provide the flexibility and retain the physical analogies of the analyser approach. The method was also intended to be suitable for the lower-speed fixed-point computers more generally available on which time is not at such a premium as those high-speed computers referred to above. In this method, described in the first paper, the network is represented in the load flow condition by a set of nodal equations written in matrix form as:—

$$[Y]\,[d]=[I]$$

in which the unknowns [d] represent the voltage of each busbar above that of a reference or " take-up " busbar. The nodal admittance coefficients [Y] are automatically computed from information supplied in the usual form of branch impedances. The network driving functions [I] are the nodal currents injected at the busbars and each depends on the system components connected to the busbar concerned, since it is usual to specify constant power loads and generation. Initial approximations to the currents [I] can be obtained from an assumed voltage distribution and the equations solved to yield better values for [d] and so on to an iterative approach to the required solution when successive values agree to within a given tolerance.

The solution of the nodal equations, which are linear in complex variables at each stage of the iteration, is feasible by many methods and it is easy to be influenced by the sub-routines generally available in the case of a specific computer. However, their solution by a process which is itself iterative, such as the modified Gauss-Seidel process described in the first paper, has many advantages, in particular:—

(a) The two iterative processes can be combined and the overall process subjected to empirical acceleration procedures which can considerably speed up the solution.

(b) Scaling for fixed-point computation is reduced to the minimum and programming is made correspondingly more simple, leading to flexibility in introducing modifications.

(c) Network coefficients are unaltered, thus reducing the storage space needed to prevent over-writing and physical correspondence is retained with data changes involving the minimum of recomputation. This feature is further facilitated by the treatment of transformer taps as injected currents.

(d) Network restraints, in the form of generating schedules or automatic tap changing, for example, can be continuously incorporated into the solution.

A further example of (d) is provided by the simple extension of the method to short-circuit studies in which the difference voltages [d] are replaced as unknowns by the busbar voltages to neutral [V] and the nodal admittance matrix modified for taps and the now constant shunt impedances to become $[Y']$. This computation is carried out automatically from the pre-fault load flow solution as is the determination of the new driving functions which are the generator voltages [Eg] behind approximate admittances [yg]. The resulting equations:—

$$[Y']\,[V]=[yg\ Eg]$$

are "exact," i.e. they do not require an iterative process for their solution, but the previously used modified Gauss-Seidel process is again recommended with the voltage of the faulted busbar continuously restrained to zero until the solution converges, thus simulating a short circuit at that location. The application of simultaneous short circuit or the inclusion of, say, voltage regulator effects, is particularly simple by the use of this method.

The overall iterative processes described can be regarded as formulated relaxation solutions of the problem and this is virtually the way in which a network analyser proceeds to the solution of a load flow problem. It is felt that the method retains a maximum physical correspondence and provides the user with as flexible an approach as is consistent with a numerical solution of his problem. As is often the case, the more closely a method of analysis is related to the physical problem, the more flexible it is and for this reason it is felt that the method may be well suited for use on a wider variety of network problems than have so far been examined in detail.

Programmes

The second paper describes three programmes which have been developed for problems of power system analysis, power system load studies and the calculation of power equation coefficients and rotor angles for transient stability studies. The load study programme was used to calculate the busbar voltages and transmission circuit loadings resulting from a specified loading condition for a system. The programme was so arranged that further studies on the same system for different loading conditions or changes to the network could be carried out automatically by the computer.

The transient stability programme was used to compute, by the usual step-by-step method, the swing curves of the generators following a disturbance in the system. This programme is divided into two parts; in Part 1, the power equation coefficients and other necessary data for the machines in the system for each of the different switching conditions are calculated. These coefficients are required to calculate the power output of each machine from the rotor angles after every time interval. Part 2 consists of the rotor angle calculation by the step-by-step method. As in the load studies programme, stress had been laid on fully automatic operation of the computer so that a series of studies could be carried out without any manual intervention. An elementary form of control programme had been developed which could be used to determine either the critical switching time for the system or its stability for a given sequence of fault and switching operations.

Significant generator characteristics, which were normally neglected in network analyser studies, had been included in the programme. Simple representation of saliency, flux decrement, voltage regulator action, damping and governor action could all be taken into account.

The methods employed are similar to those used at present on network analysers, but improvements have been made where possible. In the method of solving load studies, loads and generation are represented by equivalent admittances to neutral, and nodal voltage equations are used. A control programme which automatically adjusts the reactive power generation and transformer taps to keep the voltages within satisfactory limits has been developed.

DISCUSSION

Mr. J. G. Miles (A.E.I.), in opening the discussion, said that in the four years since the publication of the first British paper on the subject, the use of digital computation in load flow, fault and transient stability studies had become respectable, even if not yet fully accepted as an alternative to network analyser calculations. Experience had shown that a fully general digital load flow programme should be able to deal adequately with (a) small values of nodal self-admittances, and operating conditions near the voltage stability limits; (b) the introduction of small changes to an established balance, e.g. in generating specifications, transformer taps or line outages. To make the most efficient use of large computers, all possible variations in system arrangement should be programmed in advance and the computer allowed to select the optimum according to some given criterion.

Mr. D. G. Hawkins (Central Electricity Generating Board) made a plea for the digital computer to be considered in isolation from the network analyser. There was, he said, too much of a tendency to make the former follow the work of the latter. In any digital problem, it was important to be clear about what one was trying to do, so that one could express it simply. Time spent in writing this out beforehand would make it possible to use relatively unskilled staff in carrying out the work.

Mr. K. C. Parton (G.E.C.) said that the fact that up to now digital programmes had not been used for routine network calculations was a vindication of the ordinary a.c. network analyser. If one used a large analyser of the Blackburn type many of the shortcomings mentioned by Mr. John disappeared, and it was possible to achieve results comparable with digital solutions. Simple power system load studies on the analyser in parallel with Dr. Gupta's programme, suggested that there was still much to be done: convergence had not been obtained. Before more advanced programmes were attempted the question of rapid convergence should be studied more carefully. It was important not to become the slave of the computer. The best programme might well be one that provided an accurate analysis and left the synthesis in the hands of the designer. The system analyst could then sit at a control desk, study the results, make alterations, try again, and so on—using the computer much as one would use a network analyser.

Importance of Careful Preparation

Dr. P. D. Aylett, in congratulating Mr. John upon having done so well with such an extremely slow machine, said that at present machines were being designed that could execute an instruction 10,000 times faster. Computers had already transformed design methods in many industries, and would inevitably do so in the electricity supply industry as well. In network analysis, too much attention had been given to the production of numerical results. The strength of the digital computer was its ability to execute logical programmes, to choose between alternatives. Enormous advantage was to be derived from thinking carefully beforehand about what was wanted, and specifying this in a clear way. He had had considerable experience with Dr. Gupta's programme, and had obtained solutions at the first attempt. One of the difficulties was that the load flow problem was not mathematically specified: in particular, one did not know the reactive losses on the system. If magnetic tape were used to store some of the intermediate results, the programme could deal with some 60 busbars.

M. Marique (C.P.T.E., Brussels) said that in Belgium the Gauss-Seidel iteration process was used for the study of load flow. He then described the four main types of control employed.

Mr. D. G. Taylor (Nelson Research Laboratories) said that the suggestion that future system engineers might sit at computing centres, studying the results and making necessary adjustments, etc., might not be welcomed at those centres. It might appear to be an easy way out, but he thought that in the long run it was more likely that the difficulties of finding acceptable load flows would be overcome by the development of comprehensive control programmes.

Mr. T. W. Berrie (C.E.G.B.) stressed the importance of network conditioning, and said that if one presented a well-conditioned network to the existing digital programmes they proved very effective indeed. In the small system, the network analyser simulator was best for transient studies. When one had more than about six generators one should seek a digital solution. To the system operations department the " feel " of the network would always be important, and for this an analogue representation was obviously needed. However, with experience, one could develop " feel " with a digital computer also. He had been surprised at Mr. John's suggestion that the installed cost of a modern network analyser appeared to approach that of the high-speed computer. Of all analytical tools the modern network analyser was probably the cheapest.

Load Flow Studies

Mr. Marchand (South of Scotland Electricity Board) expressed the conviction that, for organisations such as the Electricity Boards, it was better to have separate analogue equipment for each type of problem. He gave the following estimates of the time required for the study of load flows on a 50 c/s conjugate network analyser: setting up and connecting, 40 minutes; balancing, 15 minutes; single-end reading, 10 minutes; total 65 minutes. The low-speed digital computer would take 141 minutes, of which approximately 120 minutes would be occupied in what could be termed the equivalent of balancing. If preparatory work was not taken into account, much less time was spent on the network analyser. Further studies, carried out on the latter, took 15 minutes, compared with 100 to 130 for the digital computer.

Mr. D. A. Newey (G.E.C.) described work done in applying the computer to other aspects of power system analysis than load flow and transient stability. A large digital computer had, he said, been used in parallel with a network analyser to obtain the most economical use of both tools. This had been very effective in obtaining transient stability swing curves, especially following the study of power flow.

Mr. M. D. Bakes (G.E.C.) said that, before contemplating the extension of the present work to more comprehensive programmes suitable for the largest networks, it was important to consider whether to employ the Gauss-Seidel iterative scheme or to perform an explicit inversion. The latter appeared to have a number of significant advantages. For example, in the second paper it appeared that, in the calculation of power equation coefficients, the process of system reduction followed by matrix inversion was repeated for each fault condition. This could be avoided if one omitted the system reduction and inverted the full system matrix for the pre-fault condition. Having produced this inverse, the inverse for any fault condition could be found by a combination of column and row matrix multiplication and one matrix addition.

Mr. A. Brameller (A.E.I.), referring to the load flow programme described by Mr. John, said that with some systems slow convergence, or none at all, was experienced. With a view to reducing the difficulties caused by systems having weak diagonal terms in the admittance matrix, the Gauss-Seidel process had been replaced by a direct matrix inversion process for both the load flow and short-circuit studies. Difficulties had still been encountered with the load flow programme for systems operating close to the voltage stability limits, and attention had therefore been given to improving the method and to carrying out iterative calculations, maintaining constant voltage and power at specified busbars.

Dr. J. R. Mortlock, urging that future computers should incorporate a control system, said that with 50 nodes and 100 circuits, if an operator lost a circuit it would take him, even with an I.B.M., about two hours to work out that the situation was serious.

Mr. K. J. Eales said that the digital computer had proved to be a powerful tool in the hands of even an " ordinary " engineer. Having had to carry out a system study he was able, after reading the instructions for half a day or so, and receiving some help from a computer operator, to use the computer to good advantage.

Mr. H. J. Goldberg, referring to earlier comment, said that the cost of carrying out a study, and the time taken in obtaining a digital solution, depended on both the computer used and the coding of the programme. For a Gauss-Seidel programme on Pegasus I, with a seven-busbar system, the time per iteration was 3-4 sec, whereas with the inverse matrix method one also had to allow for the time taken to invert the matrix. For Sirius, which was much smaller and cheaper, the time was 12 sec. Here speed had been sacrificed so that larger systems could be analysed. The size of the system that one could study was equally dependent upon the way in which the programme was coded.

Reactor Pressure Vessels

AT present, the maximum shell thickness for steel reactor pressure vessels is generally thought to be 4½in. This thickness is limited by the ability of steel mills to produce a suitable homogeneous plate and the ability to make and inspect the weld. These facts were brought out in a paper by M. J. Noone, M.I.MechE., and R. F. Bishop, M.A., A.M.I.Mech.E., on " Pressure Vessels for Gas-Cooled Graphite-Moderated Reactors " which was read before an ordinary meeting of the Institution of Mechanical Engineers in Manchester yesterday (Thursday).

The most serious immediate problem limiting the thickness of the vessel was weld inspection. A great deal of work was being carried out developing radiographic techniques of greater sensitivity for thick plate with cobalt sources of exceptional size, betatrons and accelerators. It was possible that a final satisfactory solution would be reached only by a combination of techniques. The most likely combination was ultrasonic testing and radiography.

Financial Section

STOCKS and SHARES

MARKET reactions to the Government's first step in the direction of easing the credit squeeze were localised and appropriately restrained. So far as it affects such items as refrigerators, washing machines and television sets, the extension of the hire-purchase repayment period from two to three years has apparently been seen as a small concession when measured against the size of the unsold stocks which are reported to have accumulated in some of the industries concerned. There was nothing particularly helpful in the rest of the news, so that the maintenance of a very firm trend in industrial share prices was accredited largely to the re-investment of the tens of millions now being paid out to former holders of Ford Motor shares.

Firm Markets

Not many of the week's improvements in electrical shares could be traced directly to the hire-purchase concession, but the latter contributed no doubt to the signs of more interest in shares such as Radiation and Wilkins & Mitchell, while those of Lucas, S. Smith and Pressed Steel reflected a better feeling towards investments in the motor industry. Shares of the major electrical groups mostly maintained recent gains, although A.E.I. slipped back to 41s 3d. G.E.C. stood at 31s 6d just before the interim dividend declaration. Crompton Parkinson came in for particularly good support up to 12s 3d. The upward movement in B.I.C.C. continued to 57s, and other cable shares were the same way inclined. In the heavy engineering section, International Combustion and John Thompson showed up well.

Higher Prices

Shares of International Computers & Tabulators, which had risen 7s 6d in the previous week after the announcement of the coming capital issues, rose a further 2s 6d to 71s 3d. Plessey put on another half-a-crown to 50s, and among the fairly numerous other gains recorded in the electrical lists were those in Ward & Goldstone, E.M.I., Cambridge Instrument, Alwyn Holdings and A. F. Bulgin. Arcolectric 1s shares were marked up to 4s after the company's announcement of a 22 per cent expansion of profits during the year ended in October. The dividend is held at last year's level of 15 per cent.

British Electronic Industries

Dealings have been taking place fairly actively at around 13s 9d in the 5s shares of British Electronic Industries, the holding company formed to effect the merger of Pye and E. K. Cole. According to statements issued two months ago the two companies pooled net assets in the neighbourhood of £18¾ million, and in the year ended

Price Changes in

Company or Board	Nom. Value	Middle price 23rd Jan.	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %	1960 High-est	1960 Low-est
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	74		3	3	4 1 0	79½	74
Brit. Elec. 1974/77	100	70		3	3	4 5 9	76	69
Brit. Elec. 1976/79	100	72		3½	3½	4 17 3	79½	72½
Brit. Elec. 1974/79	100	82		4¼	4¼	5 3 9	90½	81
Brit. Elec. 1967/69	100	89½		4½	4½	4 19 0	97½	90
Overseas Electric Supply								
Calcutta Elec.	£1	21/-		7†	7½†	11 14 0	21/-	19/3
East African Power	£1	14/-	+6d	8	10	14 5 6	20/3	13/-
Nigerian Elec.	£1	17/-		8	10	11 15 6	19/9	15/6
Perak Hydro-Elec.	£1	18/-		10	10	11 2 0	21/-	15/3
Electrical Shares								
Aberdare Holdings	5/-	14/6		17½	17½	6 0 9	19/-	14/6
Aerialite	1/-	7/3		54	54	7 9 0	9/6	6/3
Allen, W. H.	£1	37/-		14	10*‡	5 8 0	43/9	34/6
Allied Insulators	5/-	9/-		—	20	5 11 0*	11/6	9/-
Alwyn Holdings	5/-	26/3	+1/3	—	12½	2 7 6	30/6	17/9
Anglo-Portuguese Tel.	£1	24/3	−6d	9	9	7 8 6	29/-	22/6
Arcolectric	1/-	4/-	+3d	15	15	3 15 0	5/6	3/9
Aron Meters	£1	68/-	−9d	15	15	4 8 3	90/-	47/-
Assoc. Elec. Ind Ord.	£1	41/3	−1/3	15	15	7 5 6	66/6	39/6
Automatic Tel. & El.	5/-	16/3		17	17	5 4 6	21/9	14/6
Babcock & Wilcox	£1	31/9	−3d	13	9	5 13 3	48/9	32/6
Bakelite	10/-	43/-		15	17½	3 7 6*	52/-	33/6
Baldwin, H. J.	2/-	1/6		20	—	—	2/6	1/9
Berry's Electric	5/-	37/3		30	30*‡	4 0 6	38/6	22/3
Bowthorpe Holdings	2/-	8/-		27	18½*	4 12 6	11/6	7/9
Brit. Elec. Resistance	2/-	7/3		17½	17½*‡	4 16 6	8/3	4/6
Brit. Elec. Traction: Def. Ord. " A "	5/-	47/-	+3/6	35	40	4 5 0	49/3	42/-
Brit. Electronic Ind.	5/-	13/9	−1/-	—	15‡	5 9 0	—	—
B.I. Callender's	£1	57/-	+1/-	13½	13½	4 14 9	61/-	47/9
B.I. Callender's 6% Pref. ...	£1	18/6		6	6	6 9 9	21/-	18/6
British Thermostat	5/-	32/6	+2/6	35	20*	3 1 6	32/6	21/3
Brook Motors	10/-	48/6		25	25*	5 3 0	53/6	43/9
Bulgin, A. F.	1/-	9/6	+1/3	50	55	3 17 3	10/3	8/-
Bulpitts	5/-	17/6		15	16½	4 12 9	23/3	16/6
Burco Dean	5/-	9/3		18	15	8 2 3	15/9	8/9
Cable & Wireless	5/-	15/9		10	10*‡	3 3 6	18/3	14/3
Cambridge Instruments	5/-	32/-	+1/-	11¼†	12½†	3 3 9	33/-	24/9
Chloride El. Storage " A " ...	£1	74/-		20	17½*	4 14 6	81/-	65/6
Clarke Chapman	£1	45/-		13¾	13¾	6 2 3	63/9	45/-
Combined Elec. Mfrs.	4/-	8/-		—	12½‡	6 5 0	8/6	8/-
Contactor Switchgear	5/-	15/-		14	14	4 13 3	17/9	14/6
Cossor, A. C.	5/-	7/-		5	Nil	—	10/-	5/-
Crabtree	10/-	27/6	−6d	20	12½*	4 11 0	39/6	24/-
Crompton Parkinson	5/-	12/3	+6d	14	12½*	5 2 0	15/-	10/9
Davis & Timmins	5/-	30/6		20*	30‡	4 18 3	35/-	17/-
De La Rue	10/-	56/6		22½	22½‡	3 19 0	78/6	47/9
Decca " A "	10/-	53/-	−3d	20	23½	4 8 0	51/3	40/9
Desoutter	5/-	50/-		21¾	30	3 0 0	50/-	37/6
Dewhurst	2/-	8/3		20	20	4 17 0	8/6	7/-
Dictograph Tel.	2/-	9/6	+6d	20	20*	4 4 3	9/9	7/9
Dimplex	5/-	54/6	+9d	—	30	2 5 9*	48/-	22/6
Dubilier Condenser	1/-	2/3		25	30	6 13 3*	3/3	2/3
Duport	5/-	12/9		17½	20	5 4 6*	20/-	12/9
E.M.I	10/-	44/9	+2/3	20	17½*	3 18 3	58/9	41/9
Eleco	2/-	4/9		20	20	4 4 3	4/6	2/6
Electrical Apparatus	5/-	16/9		14½	20	5 19 6	18/3	12/9
Electrical Components	5/-	9/3		15	11½*	6 4 3	13/9	9/6
Elec. Construction	£1	31/3	+6d	9	9	5 15 3	43/-	31/3
Elliott-Automation	5/-	27/6	+9d	9·3	12‡	2 3 9	36/-	19/9
Enfield Rolling Mills	£1	48/-	−6d	15	15	6 5 0	56/-	45/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

March, 1960, their earnings (before tax) exceeded £3 million. In view of the subsequent deterioration in trading conditions, the seriousness of which was further underlined last week in a statement from Mr. C. O. Stanley, no firm estimates were given for the twelve months ending this March, but the directors saw a likelihood of substantially lower profits. It was hoped that it would be possible to pay a dividend of 15 per cent, and so to maintain the income of both companies' shareholders at the previous year's level, but the decision would have to wait until the full results were available.

Electrical Investments

Company or Board	Nom. Value	Middle price 23rd Jan.	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %	1960 High-est	1960 Low-est
Electrical Shares—continued						£ s d		
English Electric	£1	33/9		14	10*	5 18 6	53/-	29/6
English Electric 3¾% Pref ...	£1	11/9		3¾	3¾	6 7 9	13/-	11/-
Ericsson Tel.	5/-	25/-	−6d	13†	13†	4 4 6	28/6	20/6
Ever Ready	5/-	32/3	+3d	27½	20*	3 2 0	34/6	23/-
Falk Stadelmann	£1	22/6		10	7½	6 13 3	35/9	22/6
G.E.C.	£1	31/6	−6d	10	10	6 7 0	47/6	29/6
G.E.C. 6½% Pref.	£1	19/6		6½	6½	6 13 3	22/3	19/6
General Cables	5/-	4/-		Nil	Nil	—	10/-	4/9
Goblin (B.V.C.)	5/-	6/6	−1/-	12½	10	7 13 9	13/9	6/-
Hackbridge Holdings	5/-	5/9		20	20	8 14 0*	8/9	5/9
Harland Engineering	5/-	16/-	−3d	14	16*	5 0 0	16/3	13/-
Head Wrightson	5/-	23/-		20	14*	3 0 9	31/6	20/6
Heatrae	2/-	13/9		20	22½	3 5 6	13/-	8/9
Holophane	5/-	18/3	+6d	26	30	8 4 6	20/6	16/-
Hoover	5/-	47/6		60	90	4 14 9*	55/-	39/6
Hunt, A. H.	4/-	18/9	+6d	15	20	4 5 3	24/6	16/9
Intl. Combustion	5/-	30/-	+1/3	30	30	5 0 0	46/9	23/3
Intl. Computers & T.	£1	71/3	+2/6	10	11½	3 3 3	78/6	58/9
Johnson & Phillips	£1	19/6	+1/3	5	Nil	—	24/-	16/9
Kenwood Mfg.	1/-	6/-		—	—	—	12/-	3/9
Laurence Scott	5/-	15/6	+3d	15	15*	4 16 9	25/3	15/9
Lister, R. A.	£1	50/-	+2/6	14	14	5 12 0	62/-	52/-
Lucas, J.	£1	63/9	+1/3	12½	13¾	4 6 3	74/6	58/9
Marryat & Scott	2/-	13/9		22½	27½	4 0 0	16/9	13/6
Mather & Platt	£1	42/6		10⅝	11	5 3 6	59/-	42/6
Metal Industries	£1	55/-		14	15	5 9 0	76/3	52/6
Midland Elec. Mfg.	£1	60/-		10	12	4 0 0	61/-	53/6
Murex	£1	42/6	+9d	15	20	5 7 0*	45/-	35/6
Newman Ind.	2/-	5/3		10	12½	4 15 3	5/3	4/-
Oldham & Son	1/-	2/3		17½	17½*‡	7 15 6	3/-	1/9
Parsons, C. A.	£1	49/3	+1/-	8½	9¾	3 16 0	59/-	44/-
Philips' Lamps	Fl.10	235/-		13·3	17	1 8 9	£12¾	137/-
Plessey	10/-	50/-	+2/6	15½‡	17‡	3 8 0	60/-	43/9
Pullin, R. B.	2/-	11/6	−9d	25	25	4 7 0	14/3	10/-
Pyrotenax	5/-	50/-	+1/3	34	40	4 0 0	56/-	44/3
Radiation	£1	34/9	+1/-	6	12	6 18 0	44/6	28/-
Reliance-Clifton	5/-	24/-	+1/-	15	15	3 2 6	28/-	22/-
Reyrolle	£1	40/-	+1/3	17½	17½	4 7 6*	52/3	33/9
Richardsons Westgarth	10/-	7/-	+3d	8½	8½	—	14/9	6/3
Sangamo Weston	10/-	26/9	+6d	12½	11*	4 2 3	27/-	19/3
Scott, James	5/-	27/6		24	25*	4 11 0	34/6	27/6
Simon Engineering	5/-	31/-	+1/3	—	26·6‡	4 6 0	33/-	28/-
Smith (England), S.	4/-	17/6	+6d	17½	20	4 11 6	20/-	15/6
Southern Areas	£1	14/9		Nil	5	6 15 6	16/-	13/-
Strand Elec.	5/-	12/6		20	14·6*	5 16 9	14/-	10/6
Sturtevant	5/-	14/-	+6d	15†	15†	8 15 0	24/3	13/-
Sun Elec.	5/-	17/6		15	18½	5 5 9	17/6	15/-
T C.C.	10/-	41/-		25	35	5 14 0*	48/3	37/3
Telephone Rentals	5/-	24/-	+1/9	12½	15*	3 2 6	24/-	17/-
Thompson (John)	5/-	16/-	+1/6	25	20	6 5 0	25/9	14/6
Thorn Elec.	5/-	46/3		20	25	2 14 0	55/6	44/3
Thornycroft	£1	30/-	−1/6	6	6	4 0 0	31/-	20/3
Tube Investments...	£1	73/9	−2/3	—	14	3 16 0	95/6	65/3
Ultra Electric	5/-	13/6	+9d	20	25	9 5 3	29/-	12/-
Walsall Conduits	4/-	11/3		22½	15*	5 6 9	16/-	10/9
Ward & Goldstone	5/-	27/3	+1/-	30	35	3 4 3*	31/3	25/6
Watford	2/-	10/6	+3d	25	25	3 16 3*	14/-	7/6
Westinghouse	£1	38/6	−3/3	11	11	5 14 3	59/9	38/9
West, Allen	5/-	12/6		12½	12½*	5 0 0	17/-	11/-
Wilkins & Mitche'l	5/-	14/9	+1/3	17	21*	—	25/9	13/6
Wolf Electric	5/-	15/-	+3d	10	12½	4 3 6	14/9	10/9

Interim Warnings

There was a sharp recovery, to 13s 6d, in the 5s shares of Ultra Electric after the declaration that the interim dividend on account of the year ending in March is being maintained at 7½ per cent, although the announcement was accompanied by a warning that this year's results were unlikely to equal the last figures. As in the case of British Electronic Industries, the final dividend recommendation will have to be considered when the accounts for the full period have been made up. An announcement in very similar terms came from Radio & Allied (the group which includes Sobell and McMichael). Here also the interim payment is being repeated at 7½ per cent. This year's profits are expected to be appreciably reduced, but to reach a reasonable level. The 5s shares were subsequently quoted at about 20s 6d.

Goblin Dividend

Publication of the preliminary statement on the Goblin (B.V.C.) company's annual results coincided with news of the modest hire-purchase concession. The extent of the reduction in the company's earnings and dividend seemed however to have been larger than expected and the price of the 5s shares was reduced further to 6s 6d, which is less than half their value at this time last year. After the deduction of losses incurred by subsidiaries, the group profit after tax for the period ended last September is down from £126,000 to £40,000, which covers with a moderate margin the recommended dividend of 10 per cent for the year. The latter is 2½ per cent less than the 1959–60 payment, and brings the yield on the shares to nearly 7¾ per cent.

Westinghouse Results

The minor recession in profits reported by Westinghouse Brake and Signal for 1959–60 is in line with the chairman's view a year ago that they might not be quite as good as those of the year before. Ahead of the company's full report, it is imagined in the market that the slowing down of the railway modernisation programme will have acted as a brake upon the company's progress. There is no difficulty in maintaining the dividend at the rate of 11 per cent to which it was raised last year, with an ample surplus to spare. The price of the shares, which were quoted up to nearly 60s in the early part of last year, has drifted to 38s 6d, and the yield now approaches 5¾ per cent.

REPORTS and DIVIDENDS

Goblin (B.V.C.), Ltd., is reducing its dividend by 2½ per cent to 10 per cent for the year to 30th September, 1960. Group profit fell from £250,540 to £114,422, after absorbing losses in certain subsidiary companies including an overseas subsidiary in which a further charge for doubtful debts of £11,479 has been made against the general revenue reserve of that company. The net profit is down from £125,797 to £40,806, after U.K. tax of £72,495, against £128,488. The amount attributable to the holding company, after eliminating outside losses, is £60.148 (£131,179). It is pointed out that the subsidiaries in the aggregate show a net trading loss.

Ultra Electric (Holdings), Ltd., is repeating its interim dividend at 7½ per cent on the £1 million ordinary capital in respect of the year ending 31st March, 1961, but the directors state that the outcome of the current year's trading will not be as favourable as last year and consideration regarding the total dividend must await the final results.

The difficulties to which the radio and television industry has been subject since the summer of 1960 are well known and the group's radio and television company's activities and profits have been affected. Action has been taken to bring its operations into line with current conditions to enable a return to more favourable trading, the directors report.

The level of activity of the Electronics Company has, they add, been maintained and the outlook for the remainder of the year appears to be satisfactory.

Elliott-Automation, Ltd.—Dealings were expected to commence yesterday in the newly created £2·5 million 6½ per cent 1981/86 debenture stock. As to principal, the stock is covered over four times, while the annual interest requirement is covered more than six times by the average profits of the last three years. Moreover, in the current year the directors expect profits available for the stock's interest charge to be better than £1·368 million, compared with an annual average of £1·108 million for the last three years.

Westool, Ltd. — The authorised capital has been increased from £20.000 to £200.000. Of the new £1 shares which have been created 14.000 are being made available for subscription at the option of senior executives.

Mr. Angus Hunking, managing director, states: "The increase in capital which we are making reflects the substantial progress which we have made in recent years. We have no intention, at present, of making any public issue of shares. We are, however, convinced of the value of allowing senior executives to share in the prosperity of the company."

The General Cable Manufacturing Co., Ltd., and its subsidiary, Britannic Cables, Ltd., are again not paying a dividend. Group loss for the year ended 30th September, 1960, was £38,737 (£68,886 profit); and the group net loss after all charges but before providing for taxation was £92,608 (£20,786 profit). Income tax recoverable amounts to £26,443 (against £9,012 payable).

Head Wrightson & Co., Ltd., are again paying an interim dividend of 4 per cent.

New Companies

Supermatic (Domestic Appliances), Ltd.—Registered 23rd November. Capital £5,000. Manufacturers of and dealers in domestic electrical appliances, etc. Directors: J. Shirley, F. Forcherio and M. Sarandis. Regd. office: 7, Victoria Street, Liverpool, 2.

Trymvision (Electrical), Ltd.—Registered 14th December. Capital £2,000. Designers and manufacturers of and dealers in electrical appliances, equipment and fittings, radio and television sets, etc. Directors: W. G. Smith, Sunnie E. N. Smith (secretary) and G. T. R. Gale. Regd. office: 47, High Street, Westbury-on-Trym, Bristol.

Sidren (Woolwich), Ltd.—Registered 15th December. Capital £1,000. Manufacturers of and dealers in electrical goods, etc. Directors: D. Solomon, Gertie Solomon, S. Nathan and Rene Nathan (secretary). Regd. office: 214, Bishopsgate, E.C.2.

P. Burman (Electrical), Ltd.—Registered 15th December. Capital £100. Electricians, mechanical engineers, etc. Directors: P. Burman and Mrs. Bernice Burman (secretary). Regd. office: 36, Spring Gardens, Manchester, 2.

Frank Hardman, Ltd.—Registered 14th December. Capital £1,000. To acquire the business of electrical contractors carried on by F. Hardman at Stockport, etc. Directors: F. Hardman (secretary) and Mrs. Rose Hardman. Regd. office: 43, Buckingham Street, Stockport.

Baker & Son (Electrical Engineers), Ltd.—Registered 16th December. Capital £1.000. To acquire the business of electrical engineers carried on by Baker & Son, etc. A. H. S. Baker is the first director. Secretary: Joan F. Baker. Regd. office: Belvedere Works, Railway Terrace, Feltham, Middlesex.

Hayes & Walker (Fulham), Ltd.—Registered 19th December. Capital £1,000. Manufacturers of and dealers in electrical and mechanical apparatus, etc. Directors: S. Hayes and R. S. James (secretary). Regd. office: 61, New Kings Road, S.W.6.

J. F. Miller (Electric), Ltd.—Registered 21st December. Capital £5.000. Electrical contractors and refrigeration engineers, etc. Directors: Mrs. Grace Miller and D. C. Summer. Regd. office: 110, Osbourne Street, Hull.

A. & E. Electrics (Sunbury), Ltd.—Registered 21st December. Capital £1.000. Manufacturers of and dealers in electrical goods, etc. Directors: A. G. J. Hicks and Evelyn J. Hicks (secretary). Regd. office: "Maples," Mill Road Stock, Ingatestone, Essex.

R. & G. (Electrical Installations), Ltd.—Registered 23rd December. Capital £100. Electrical engineers, etc. Directors: J. Reissner and F. Goldberg (secretary). Regd. office: 30, Thayer Street, Manchester Square, W.1.

A. F. Meekings, Ltd.—Registered 28th December. Capital £100. Electrical contractors, etc. Directors: A. F. Meekings and Joyce S. M. Meekings (secretary). Regd. office: 199, Piccadilly, W.1.

Weaver Electrical, Ltd.—Registered 22nd December. Capital £100. Electrical, radio, electronic and mechanical engineers, etc. Directors: L. Knowles (secretary) and Mrs. Madeleine T. Hollis. Regd. office: Barclays Bank Chambers, King Street, Knutsford.

Electronics (Leeds), Ltd.—Registered 13th December. Capital £1,000. Electrical and electronic engineers, etc. Directors: L. Chapman and Florence Chapman (secretary). Regd. office: 39, West Park Road, Leeds, 8.

Kevin Electrical Industries, Ltd.—Registered 13th December. Capital £100. Secretary: J. P. Davisson, 65a, Fenchurch Street, E.C.3.

F. T. Baughen & Co., Ltd.—Registered 12th December. Capital £500. Electrical engineers and contractors, etc. Directors: F. T. Baughen, V. H. Parsons and J. J. Findlay. Secretary: L. W. Davies. Regd. office: 40, Amersham Vale, S.E.14.

Queensway Electrical, Ltd.—Registered 28th November. Capital £100. Manufacturers of and dealers in washing machines, refrigerators, television receivers, etc. H. Freedman is the first director. Secretary: C. Bryett. Regd. office: 97, Queensway, W.2.

P. J. Shone (Colchester), Ltd.—Registered 28th November. Capital £100. Electrical engineers, general electrical and refrigeration installation contractors, etc. Directors: R. J. Smith (secretary) and P. J. Shone. Regd. office: Rutlands, Chitts Hill, Colchester, Essex.

Mactric Electric, Ltd.—Registered 23rd November. Capital £100. To carry on the business of electrical engineers, etc. Directors: H. J. Knights and J. McAneny (secretary). Regd. office: 43, Raydon Street, N.19.

Power Electrical (London), Ltd.—Registered 23rd November. Capital £1,000. Manufacturers and repairers of electrical appliances and fittings, etc. Directors: F. E. Baker and P. Trummel (secretary). Regd. office: 101, High Street, Orpington, Kent.

Stromberg Electronic Development Co., Ltd.—Registered 24th November. Capital £100. To acquire the business of electronic engineers carried on by Clifford G. Douglas and James Stevenson at 32, Pencester Road, Dover. Directors: C. G. Douglas and J. Stevenson. Secretary: Thelma M. Stevenson. Regd. office: 32, Pencester Road, Dover.

Sprite Electrical Co., Ltd.—Registered 2nd January Capital £1,000. Directors: W. E. Bayliss, J. I. Levene, D. C. Matthews, A. W. Bint and E. J. Liddle (secretary). Regd. office: 54, The Avenue, Surbiton.

E. Southall & Son, Ltd.—Registered 3rd January. Capital £2,500. Electrical engineers, etc. Directors: E. Southall, Clarice Southall (secretary) and B. K. Southall. Regd. office: 152, Lazy Hill Road, Aldridge.

Supa-Ohms, Ltd.—Registered 2nd January. Capital £2,000. Manufacturers of and dealers in electrical heating elements, and resistances, etc. Directors: B. A. Harriss and Mrs. Mabel Harriss. Regd. office: Horton Street, West Bromwich.

Phoneatape, Ltd.—Registered 4th January. Capital £1,000. Electrical engineers and contractors, electricians, electronic engineers, radio and television engineers, etc. Directors: A. J. Green, J. A. F. Burt and Phyllis M. Knight (secretary). Regd. office: 1/2, Sandringham Mansions, Exeter Road, Bournemouth.

H. Broomhall & Co. (Electrical Engineers), Ltd.—Registered 4th January. Capital £2,000. Directors: H. C. A. Broomhall and

J. E. W. Bartlam. Secretary: Ivy I. Broomhall. Regd. office: 148, Broadway, Leigh-on-Sea.

Q.K. Deepfreeze Co., Ltd.—Registered 3rd January. Capital £1,000. Directors: Queenie A. Walbrook and H. Walbrook. Secretary: K. Martin. Regd. office: 117, Balham High Road, S.W.12.

K. J. D. Hall, Ltd.—Registered 21st October. Capital £500. Manufacturers of and wholesale and retail dealers in and agents for domestic household and general electrical and other equipment and appliances including washing and cleaning machines, radio, etc. Directors: J. D. Hall and Mrs. Ethel E. Hall, "Penhay," Yarningale Common, Claverdon, Warwicks.

Research Electronics, Ltd.—Registered 21st November. Capital £1,000. Subscribers: Mrs. May Lines, 77, Castle Lane, Solihull, and Mrs. Anne Sugden, 13, Victoria Avenue, Cleckheaton, Yorks. (secretary).

F. & B. Electrics (Contracts), Ltd.—Registered 22nd November. Capital £100. Electrical, radio and television engineers and contractors, etc. Directors: E. A. Brimfield and Mrs. Joan L. Brimfield (secretary). Regd. office: 215, High Street, Hounslow, Middlesex.

Evolux, Ltd.—Registered 17th November. Capital £100. Manufacturers of and dealers in electrical and other equipment, etc. Directors: P. W. Peters and Evelyn J. Peters. Secretary: T. H. E. Cash. Regd. office: 15, High Street, Langley, Oldbury, Birmingham.

Boshier of Southwold, Ltd.—Registered 21st November. Capital £4,000. Motor and electrical engineers and general electrical installation contractors, heating and ventilating engineers, etc. Directors: S. J. Boshier and D. J. Samkin. Solicitor: E. A. Rutherford, Norwich.

C. & A. Electrics, Ltd.—Registered 18th November. Capital £1,000. Wholesale and retail dealers in domestic and household electrical appliances, equipment and utensils, etc. Directors: A. F. Cholerton and Inez M. Cholerton (secretary). Regd. office: 352, Normanton Road, Derby.

Shawford Control Gear Co., Ltd.—Registered 28th November. Capital £2,500. Manufacturers of and dealers in dynamos, motors, armatures, magnetos, etc. Directors: C. F. Ford, P. L. Norton, E. C. L. Basan and D. C. Ambrose. Secretary: June M. Norton. Regd. office: Midland Terrace, Victoria Road, N.W.10.

M. & A. (Cambridge), Ltd.—Registered 28th November. Capital £1,000. Electricians, electrical and mechanical engineers, etc. Directors: D. F. Morgan, Red Roofs, Histon, Cambridge, and M. E. Allgood, 18, Redfern Close, Cambridge.

Increases of Capital

Telegraph Condenser Co., Ltd.—Increased on 4th May, 1960, by £500,000 in 10s ordinary shares, beyond the registered capital of £880,000.

C. W. Gosling, Ltd.—Increased on 28th April by £9,000 in £1 shares, beyond the registered capital of £1,000.

F. H. Pride, Ltd.—Increased on 3rd May by £50,000 in £1 ordinary shares, beyond the registered capital of £50,000.

Dicks, Ltd.—Increased on 19th April, 1960, by £6,000 in £1 ordinary shares, beyond the registered capital of £5,000.

A. Reyrolle & Co., Ltd.—Increased on 12th May, 1960, by £5 million in £1 unclassified shares, beyond the registered capital of £6 million.

Meeting of Creditors

K. & H. Electrics, Ltd.—Meeting 31st January at 186, Hammersmith Road, London, W.6.

Winding-up Petition

Hones Electric, Ltd.—A petition for the winding-up of the company has been presented in the High Court by the Pressed Steel Co., Ltd., and is to be heard on 30th January.

Liquidations

A. W. Holmes (Radio & Electrical Services), Ltd., 128, Shirley Road, Southampton.—Winding up voluntarily. Liquidators, Mr. R. A. Hawken, 1, John Street, Bedford Row, London, W.C.1, and Mr. G. E. Radford, 12, Portland Street, Southampton, appointed by creditors on 6th January.

Mills (Electrical Services), Ltd., 131, London Road, East Grinstead, Sussex.—Winding up voluntarily. Liquidators, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton, Sussex, and Mr. G. A. Wale, 418-422, Strand, London, W.C.2, appointed by members and creditors on 12th January.

Central Appliances, Ltd., domestic electrical appliance retailers, Walter House, 418-422, Strand, London, W.C.2—Winding up voluntarily. Liquidators, Mr. S. B. Harman, 101, High Street, Orpington, Kent, and Mr. G. A. Wale, 418-422, Strand, London, W.C.2, appointed by members and creditors respectively on 6th January.

Merseyside Engineering (Refrigeration), Ltd., domestic appliance importers and distributors, 150, Caryl Street, Liverpool.—Meetings of creditors and contributories 30th January at the Liverpool Chartered Accountants Hall, 5, Fenwick Street, Liverpool, 2.

Windles (Nelson), Ltd., electrical factors, 11, Nicholas Street, Burnley, Lancs.—Winding up voluntarily. Liquidator, Mr. E. Moulds, of the above address, appointed by members on 5th January.

Darwen Electrics, Ltd., electrical goods retailers, 153, Duckworth Street, Darwen, Lancs.—Winding up voluntarily. Liquidator, Mr. G. H. Eaves, 47, Mosley Street, Manchester, appointed by members and creditors on 16th January. Particulars of claims to the liquidator by 28th February.

Regent Electrical Distributors (Middlesex), Ltd., electrical wholesalers, 987, High Road, North Finchley, London, N.12.—Winding up voluntarily. Liquidator, Mr. J. T. Morgan, 100, Park Street, London, W.1, appointed by members on 11th January.

Bankruptcies

G. M. Hardy and **J. F. King,** who carried on business together at Hamilton House, The Platt, Wadebridge, Cornwall, as Hardy & King, electrical dealers.—Receiving order made 19th December on debtors' petition. Public examination 10th February at the Town Hall, Truro. Trustee, Mr. J. E. Ellis, Ford Park Chambers, Ford Park Road, Plymouth, appointed 18th January.

D. Peters, electrician, lately trading at 2, Manor Road, Carlton, Notts., as Denis Peters Electrical.—Receiving order made 18th January on debtor's petition.

T. Marshall, carrying on business under the style of W. H. Jones & Co., and Purda Automatic Devices, at 1a, Sugar Lane, Manchester, 4, as an electrical contractor.—Trustee: Mr. W. H. Meredith, 20, Byrom Street, Manchester, 3, released 20th October.

T. K. Underwood, lately trading in partnership with others as Fourways Electrical Services at 68, Carter Lane, Mansfield, Notts., and 18, Market Place, Shirebrook, Derbys., retailers of radio, television, and electrical appliances.—First meeting held 29th December. Public examination 2nd March at the Court House, St. Peter's Gate, Nottingham.

C. T. Powell, 31, St. Peter's Road, Bury, Lancs., lately residing at "Stokesay," Racecourse Road, Lindow Common, Wilmslow, Ches., and carrying on business at Station Road, Wilmslow, as an electrical engineer under the style of George Cooke & Co.—Public examination 28th February at the Town Hall, Macclesfield.

F. C. Turner, domestic electrical appliance dealer, electrical and motor engineer and financier, carrying on business at 112, St. Sepulchre Gate, Doncaster, under the style of "Ross Electrics," "Ross Engineering" and "Eros Security"; at 127, Hessle Road, Hull, under the style of "Ross Electrics"; at 14, Bentinck Street, Doncaster, as "Ross Electrics" and "Ross Engineering"; and formerly carrying on business at 28, Springwell Lane, Balby, Doncaster, 18, South Parade, Doncaster, 127, Spring Bank, Hull, 2, Green Street, Huddersfield, 9, Eldon Terrace, Leeds, and Cherry Lane, Marshgate, Doncaster.—Trustee, Mr. P. Cardwell, 93, Queen Street, Sheffield, appointed 14th December.

P. Hirst, formerly carrying on business as Television Services (Longsight) at 8, Longsight Road, Holcombe Brook, Bury, Lancs., electrical equipment sales and service engineer.—Trustee, Mr. J. A. Freeman, 8, Manchester Road, Bury, appointed 22nd December.

J. W. McEvoy, lately carrying on business at 246, Easterley Road, Leeds, 8, and at Hurst House, Dewsbury Road, Ossett, Yorks., as Domestic Electrics, electrical appliance dealer.—Trustee, Mr. R. W. Hellyer, Brotherton Chambers, Westgate, Leeds, appointed 21st December.

Defiant Electrical Products (sued as a firm), lately carrying on business at 41, King William Street, Coventry.—First meeting held 13th January. Public examination 27th March at the County Hall, Coventry.

W. H. Hughes, lately carrying on business at 6, Belvedere Drive, Plas Coch, Wrexham, Denbighshire, as an electrical contractor, and formerly carrying on business there with another as Conde & Hughes, electrical contractors.—First meeting held 17th January. Public examination 23rd February at the County Hall, Police Buildings, Wrexham.

F. J. Woods, lately carrying on business as Mercury Electrics at 91, Market Street, Chorley, Lancs., electrical goods retailer.—Trustee, Mr. L. H. Shipton, 31, Lloyd Street, Manchester, appointed 3rd January.

C. A. L. Parry, electronic engineer, lately residing at 49, Dale Crescent, Patcham, Brighton, and now at 2a, Withyham Avenue, Saltdean, Sussex.—First meeting held 19th January. Public examination 24th March at the Court House, Church Street, Brighton.

L. A. James, radio and electrical engineer, carrying on business at 42, Clare Street, Bridgwater, Som., and trading as Domestic Electrics.—First meeting held 30th December. Public examination 16th February at the County Court Offices, Queen Street, Bridgwater. Trustee, Mr. P. W. Hort, 28, Baldwin Street, Bristol, appointed 10th January.

D. C. McCallum, lately carrying on business as a domestic electrical appliance proprietor, under the style of Bristol Utilities, at Fox Road, Eastville, Bristol, and at 294, North Street, Bedminster, Bristol.—First meeting held 24th January. Public examination 24th March at the Old Council House, Corn Street, Bristol, 1.

S. N. Folkard, electrical dealer, 183, Lee High Road, London, S.E.13.—First meeting held 24th January. Public examination 16th March at the County Court, Scarbrook Road, Croydon, Surrey.

D. Boulton and **L. C. Turner,** lately carrying on business in partnership under the name of Derek Boulton at Old Town Avenue, Plymouth, radio and electrical engineers. (Separate application of D. Boulton).—Application for discharge to be heard on 14th February at 4, Elliot Street, The Hoe, Plymouth.

F. H. C. Bishop, electrical dealer, trading as Wellington Electrics, 31, High Street, St. Mary Cray, Kent.—Receiving order made 9th January on a creditor's petition. Public examination 16th March at the County Court, Scarbrook Road, Croydon.

V. G. Parker, formerly trading as Parkers Electrical Services, 430, High Street, Smethwick, Staffs., electrical dealer.—First meeting held 20th January. Public examination 22nd February at the Law Courts, Lombard Street West, West Bromwich.

G. D. Chaplin, 18, Manor Road, Woodford Bridge, Essex, electronics engineer.—Receiving order dated 30th June, 1960, rescinded, provision having been made for the payment of debts in full.

INDUSTRIAL NEWS

Hire-Purchase Controls Eased

SOME relaxation in the hire-purchase restrictions that were imposed last April was announced last week by the Board of Trade.

From Friday, 20th January, the maximum period for the payment of the balance due under hire-purchase and credit-sale agreements on those domestic electrical appliances (see below) on which there has been a two-year limitation, is extended to three years. The rates of deposit remain the same.

At the same time the Board of Trade has strengthened the regulations affecting hiring agreements. Hiring agreements under which the lowest rental is less than 25 per cent of the highest rental during the period of the agreement are now prohibited. It is also provided that payment of an amount equivalent to the advance rental is to be made where a person is in possession of scheduled goods for fourteen days or more in anticipation of the making of a hiring agreement.

These regulations are designed to stop the use of rental agreements as a means of evading the h.p. restrictions. In some cases unduly long "free-trial" periods have been offered.

Mr. Maudling, President of the Board of Trade, said last week that relaxation of the hire-purchase regulations should not be taken to represent any major change in the Government's judgment of the economic situation.

Nevertheless, the hire-purchase restrictions were now more severe than could be justified by the needs of the balance of payments, and certain industries were suffering disproportionately. Again the sharp decline in sales had also been considerably affected by the belief among the buying public that the Government would soon do something to make things easier.

Manufacturers should now be able, he said, to look forward to a period of stability without the danger of fresh, abrupt changes.

Mr. Maudling said he believed there "is now an urgent need for a greater and more consistent rate of industrial expansion. In order to achieve this without danger to our currency, exports and investment must be given priority."

Domestic Appliance Firms Disappointed

It seems unlikely that the relaxation in the hire-purchase regulations will lead to any strong revival in the sales of those domestic appliances, particularly washing machines and refrigerators, that have been most affected. In contrast to motor cars, it is generally agreed that with domestic appliances the size of the deposit and not the repayment period is the main factor discouraging sales. There has therefore been disappointment among domestic appliance manufacturers that the deposit has not been reduced.

A spokesman for the English Electric Co., Ltd., said: "We are disappointed. The extension of the period of repayment to three years will not really help the domestic appliance business very much. The relaxation in the Order will obviously help the motor industry because they deal in 'trade-ins' which represent deposits.

"We recommended to the Board of Trade that they should consider a down-payment of 10 per cent and a repayment period of three years, with stability of policy."

Mr. S. F. Steward, director of the British Electrical and Allied Manufacturers' Association, said: "The Association is very sorry that the Government has not yet seen fit to take action to reduce the deposit required on electrical appliances. Above all, however, it regrets that the Government has given no indication of a stable policy for the future."

In a subsequent letter to *The Times*, Mr. Steward re-emphasised that the extension of the repayment period was likely to bring little comfort to the manufacturers of domestic electrical appliances. He also referred to the serious effect that the continued instability in trading conditions was having on manufacturers' large-scale production plans, which were essential to expanding exports.

"It is becoming clear that economic control by the variation of hire-purchase terms is a blunt and unsatisfactory weapon. Its main effect has not been on the total spending on consumer durables but to disrupt and discourage the highly efficient growth industries which represent our best export hopes. Some assurance of reasonable stability would be a godsend at the present time."

The Goods Affected

The electrical goods affected by the Government's extension of the hire-purchase repayment period from two to three years are:—

Radio receiving sets and television receiving sets (including portable sets and sets designed for use in road vehicles), whether or not assembled and whether or not complete, and parts thereof; television aerials, cathode-ray tubes, loud-speakers and television conversion units.

Gramophones, radio-gramophones, record players and juke boxes, tape recorders and parts thereof.

Space heating installations and appliances of a kind designed exclusively or mainly for domestic use, and parts thereof.

The following appliances and apparatus, whether mechanically operated or not, being appliances or apparatus of a kind designed exclusively or mainly for domestic use, and parts of such appliances:—Dish washers; drying cabinets and drying machines; washing machines and washers excluding washing machines and washers which are designed for heating water by electricity or gas but which are not otherwise designed for operation by electricity or gas; ironing machines and irons; wringers and mangles; floor polishers; vacuum cleaners; refrigerators having a storage capacity not exceeding 12 cu ft; machines for mixing, extracting and preparation of food and drink; electric kettles and other cooking utensils incorporating heating elements, including electric hotplates; dry shavers, electrically operated; hair drying machines; electric blankets; and electric generating plant.

Export Display

Window display at Thorn House, Upper St. Martin's Lane, London, W.C.2, which tells the story of the contribution that the group is making in the export field, selling to over 100 markets. An animated unit in one section shows a ship being loaded at the dockside and, alternating with this, a globe indicating the Thorn agents throughout the world

Plugs Made of Resilient Material

THE first supplement to B.S. 546: 1950 "Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors for circuits up to 250 V" and the second to B.S. 1363 : 1947 "Two-pole and earthing-pin fused-plugs and shuttered socket-outlets for a.c. circuits up to 250 V" deal with plugs made mainly of rubber or other suitable resilient material which have been developed for use in conditions that would probably lead to the normal type of plug being broken. Plugs complying with the supplements will be interchangeable with other British Standard plugs but may have a slight degree of flexibility of the contact pin mounting. They will, however, be rigid enough to prevent incorrect insertion. General requirements and tests are included to ensure that the plugs are manufactured to an adequate standard of quality.

Copies of these supplements may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 4s each.

Britain's Second Nuclear Submarine

The contract for the design and manufacture of the main propulsion steam turbines and condensers for Britain's second nuclear submarine—recently ordered by the Admiralty from Vickers-Armstrongs, Barrow—has been awarded to the English Electric Co., Ltd. The machinery will be built at the company's Rugby works.

New University Building at Belfast

Artist's impression of the new electrical and mechanical engineering building planned for Queen's University, Belfast. It will bring together in one block the electrical and engineering departments which are at present in temporary premises. The architects for the project are Messrs. Cruikshank and Seward

HIGHER TARIFFS IN "MANWEB" AREA

SOME details of the proposed increases in charges to meet higher costs were given by the chairman of the Merseyside and North Wales Electricity Board, Mr. D. H. Kendon, at a meeting of the Area Electricity Consultative Council on 18th January. He said that the new tariffs had not yet been formally fixed by the Board but it was intended that for quarterly consumers they should come into effect after the first meter reading following 28th February, the new maximum demand tariffs applying as from 1st April.

Mr. Kendon explained that, as a result of higher costs, including the revised bulk supply charges recently announced, the Board's expenditure during 1961-62 would be increased by £1,890,000 and the surplus of rather more than £1,400,000 which had been forecast would be changed into a deficit, unless additional revenue was obtained. The proposed increases were designed to produce a surplus of £1,400,000 in the year ending 31st March, 1962. This would be immediately absorbed in helping to pay for the £7 million worth of mains and equipment required each year to meet the growing demand for electricity.

Outlining the proposed tariff changes, he said that the primary unit rate of the domestic tariff would be raised from 5·75d to 6d (prepayment from 6·25d to 6·5d) and the second unit rate of 1·05d to 1·15d, but the follow-on rate of 0·95d would be left unchanged. For a consumer in a five or six-roomed house using 500 kWh a quarter the increase would amount to 4½d per week, while for a consumer using 1,000 kWh a quarter the increase would be 8½d per week.

Mr. Kendon said that the commercial and industrial block tariffs, and tariffs for farms (except the farm domestic tariff which would be varied as the domestic tariff) and the combined premises tariff would have the primary unit prices increased by 0·75d, and all other rates increased by 0·1d.

To continue to encourage consumers to install apparatus designed to use electricity during off-peak periods only, it was proposed that the off-peak tariff should be left unchanged at 0·9d per kWh.

The kilowatt charges under the maximum demand tariffs would be increased by 5s and the unit charges by 0·01d, the same amounts as the increases in bulk supply charges.

Productivity Study Teams

ONE of the projects administered by the European Productivity Agency is that of helping industry to arrange joint management/trade union productivity team visits between member countries. The aim is to promote a wider appreciation of technical and other improvements which are going forward in all European countries. It is designed also to stimulate joint discussion by both sides of industry of these improvements—the object being to see if some, or all, can be used profitably in the country of the visiting team.

Arrangements for team visits must be completed before 30th June. Preliminary discussions should be held between employers' organisations, trade associations and trade unions in the industry concerned for agreement to send a team. When British teams go to the Continent all arrangements are co-ordinated by the British Productivity Council, Vintry House, Queen Street Place, London, E.C.4, from whom further particulars can be obtained.

TEACHING ELECTRICAL HOUSECRAFT

The Electrical Association for Women is holding a one-day conference on the teaching of electrical housecraft at the Yorkshire Training College of Housecraft, Leeds, on Saturday, 4th March. Lectures will include cookery and laundry in the housecraft syllabus; the teaching of electrical housecraft in schools; and the E.A.W. educational programme. The conference is open to all teachers of domestic science and allied subjects. Application should be made to the E.A.W. Headquarters, 25, Foubert's Place, London, W.1, by 18th February.

C.E.G.B. Contracts

THE Central Electricity Generating Board has placed contracts during the past month for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £7,305,000. They include the following:—

Drakelow "C" power station: Circulating water pipework for units 9-12.—Aiton & Co.

Skelton Grange "B": 144 MVA, 132 kV generator transformer.—Hackbridge & Hewittic Electric Co.

Richborough power station: Railway sidings.—Grant-Lyon & Co. Booster and main boiler feed pumps for No. 3 unit.—Harland Engineering Co.

Oldbury nuclear power station: Circulating water system, river works and site preparation.—Sir Lindsay Parkinson & Co.

Thorpe Marsh power station: Building and civil engineering works at 275 kV substation.—Mitchell Construction Co.

Pyle substation: One 45 MVA, 132/66/33 kV transformer and earthing transformer.—English Electric Co.

Finsbury Market substation: Three 15 MVA, 132/11 kV transformers.—Ferranti.

Three Bridges substation: 132 kV switchgear.—English Electric Co.

Elstree substation: 132 kV switchgear.—A. Reyrolle & Co.

Wickham Market substation: 132 kV switchgear. — Associated Electrical Industries.

Barking substation: 275 kV isolators. —A. Reyrolle.

Whitson substation: 275 kV switchgear.—A. Reyrolle.

Carrington substation: 275 kV switchgear.—A.E.I.

Whitfield substation: Site and foundation works.—G. Percy Trentham.

Brinsworth substation: Foundations. —Tarmac.

Ffestiniog power station: 16 kV and lower voltage cables and earthing.—Pirelli-General Cable Works.

Northfleet power station, east and west substations: 132 kV cables.—Pirelli-General.

West Didsbury-Rifle Road: 132 kV cables and multicore cables.—British Insulated Callender's Cables.

Exeter Main-Newton Abbot: 132 kV line.—Pirelli-General.

Holborn-St. Marylebone: 132 kV cables.—Pirelli-General.

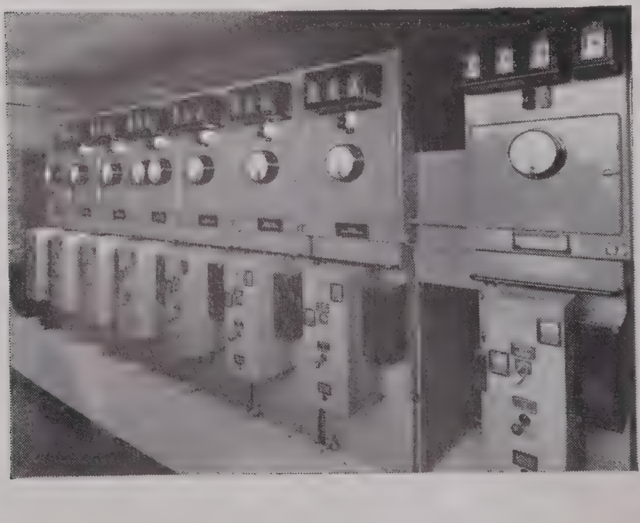
St. Marylebone-Mill Hill: 132 kV cables.—Pirelli-General.

New Hydro-Electric Station in Victoria

SINCE May last year six 16 MW generating sets supplied by the A.E.I. Heavy Plant Division have been brought into service at the McKay Creek hydro-electric power station of the State Electricity Commission of Victoria in the Australian Alps. The station is part of the Kiewa development. It is built underground and is supplied by Australia's highest reservoir, Rocky Valley, a mile above sea level. Water for the Boving turbines is conveyed through nearly three miles of tunnel, then by surface pipeline, and finally through a 630ft steel-lined pressure tunnel. The turbines work under a head of more than 1,700ft. After use the water is discharged into the East Kiewa River, where it supplies the turbines of No. 3 power station, then, passing under the mountains, it is used again to drive the turbines of No. 4 power station, on the West Kiewa River. Power is supplied to Melbourne, 153 miles away, at 220 kV.

Catterick Camp Distribution System

AN extensive works programme is now being carried out at Catterick Camp, Yorkshire, where Crompton Parkinson, Ltd., was awarded the contract for the complete change-over of the existing electrical distribution system from 3·3 to 11 kV. The contract comprises the supply and installation of 77 units of indoor and outdoor high voltage switchgear, 26 outdoor substation transformers up to 500 kVA, and the supplying and laying of about 17 miles of h.v. and m.v. cabling for the ring main distribution system interconnecting twenty-six substations.



Main intake substation at Gough Road, Catterick Camp, showing the Crompton Parkinson nine-panel indoor type 11 kV 150 MVA switchboard

TRAVELLING SCHOLARSHIPS FOR APPRENTICES

SINCE 1958 the British Junior Chambers of Commerce have organised an "Apprentice of the Year" scheme under which travelling scholarships are offered to selected apprentices. This year the scheme is being extended by raising the age limit for technical and commercial apprentices and by making subsidiary awards to all regional winners who attend the national finals. Three scholarships are to be awarded: one for technical apprentices (nine months in Australia), one for craft apprentices (six months in Canada) and the third for commercial apprentices (six months in the United States). The closing date for entries is 1st March. The chairman of the scheme is Mr. P. Rex, Kalamazoo, Ltd., Northfield, Birmingham.

Tyne Supergrid Crossing

The Central Electricity Generating Board has applied to the Minister of Transport for sanction to erect a 275 kV transmission line across the Tyne between Jarrow and Howdon as part of a new line from Blyth (Northumberland) to Lackenby (North Yorkshire). Towers 350ft high will be needed on each side of the river, giving a height of 215ft above high-water at the lowest point of the sag. The Blyth-Lackenby line is expected to cost £1,222,000, or more than £23,000 a mile.

Simplex Star Switchgear

SWITCHFUSES AND BUSBAR CHAMBERS

Simplex were one of the first to develop a complete range of front operated switchgear. The advanced design is: remarkably simple to install and maintain · low in price, and completely safe. They are available in 15, 30 or 60 amp ratings, 500 volt A.C. or 250 volt D.C. The Busbar Chambers are available in 600 volt, 200, 400, 600 and 800 amp ratings · are readily extendable · have a high through-fault capacity · universal clamp connections — no drilling — no sweating. More details of Simplex Star Switchfuses and Busbar Chambers on request.

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CREDA WORKS, BLYTHE BRIDGE
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Branches throughout Britain and Agents throughout the World

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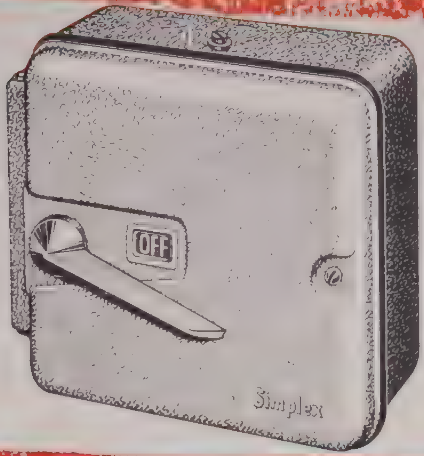
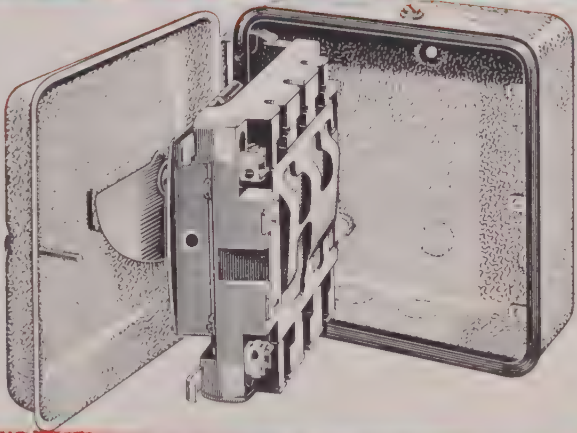
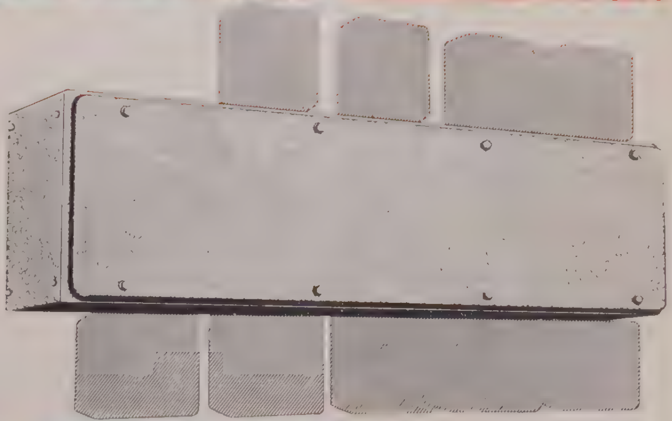


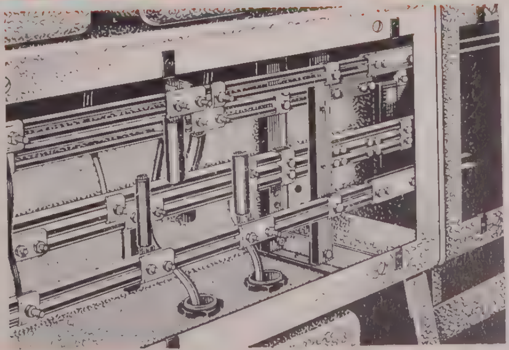
Simplex Star Switchfuse. Strong pressed steel case. Superbly styled.



Star Switchfuse with cover open showing interior hinged forward for ease of wiring.



Star Busbar Chamber.



Close up of interior of Star Busbar Chamber showing main branch terminals, and busbar arrangements.

Cables cut away for purpose of illustration

WHY INDUSTRY IS CHANGING TO CLASS C AND CLASS H TRANSFORMERS

THEY ARE FAR BETTER

Class C & Class H *silicone-insulated, dry-type transformers are fire and explosion proof. They are not affected by dust and humidity. And because they will withstand repeated overloading, rating does not have to be based on peak loads. For safety, reliability and low maintenance costs, silicone-insulated transformers hold every advantage.*

[redacted]

THEY ARE OFTEN CHEAPER

First consider all the expenditure incumbent upon the installation of oil-filled transformers. Special bunkers and fireproof vaults are usually needed—and special fire-fighting equipment. The installation is often located a considerable distance from the load centre—which implies expensive low-voltage cable runs.

Now consider the very considerable cost-cutting advantages of Class C and Class H transformers as demonstrated for instance at the Kent factory of Medway Paper Sacks Ltd, a member of the Reed Paper Group. Here a 750 kVA 3-phase air natural cooled transformer, built by Ferranti Ltd, has been neatly mounted within the roof truss space. Space limitations—making it undesirable to build an adjoining substation for a Class A unit—together, of course, with freedom from fire hazard, were the major considerations. As a Group technician pointed out, the transformer's low weight enabled it to be sited thus, on a moderately-sized platform, making it possible to run 'a very nice low voltage distribution' to individual machines without floor excavations to accommodate long, costly cable runs.

And so, in simple indisputable terms, it often costs less to have all the advantages of a Class C or a Class H installation.

Midland Silicones Ltd supply the silicone resins and elastomers used in the manufacture of Class C and Class H transformers. Here is a list of well-known British manufacturers producing silicone-insulated dry-type transformers for the United Kingdom and overseas.

Associated Electrical Industries (Manchester) Ltd
Bonar, Long & Co Ltd
Brentford Transformers Ltd
Brush Electrical Engineering Co Ltd
Bryce Electric Construction Co Ltd
Crompton Parkinson Ltd
The English Electric Co Ltd
Ferranti Ltd
Foster Transformers Ltd
The General Electric Co Ltd
Gresham Transformers Ltd
Hackbridge & Hewittic Electric Co Ltd
London Transformer Products Ltd
Bruce Peebles & Co Ltd
South Wales Switchgear Ltd
Transformers (Watford) Ltd
Woden Transformer Co Ltd
The Yorkshire Electric Transformer Co Ltd

MS

MIDLAND SILICONES LTD

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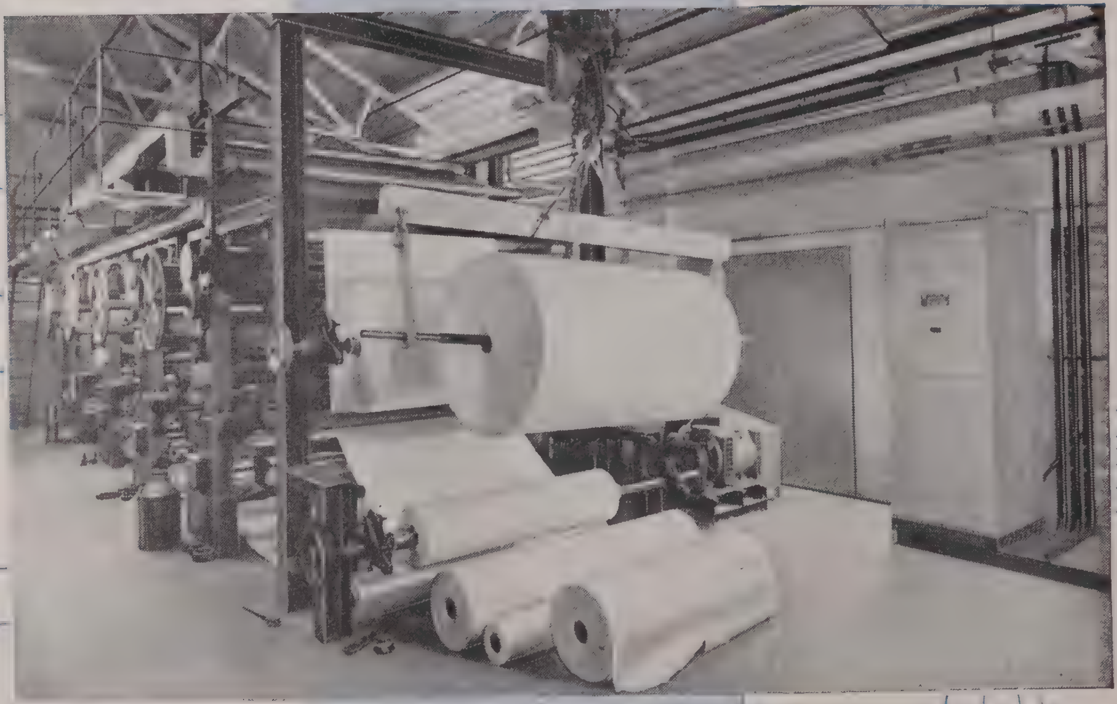
Agents in many countries

MSE1

VARIMAG MAGNETIC AMPLIFIER Variable Speed Drives



20 h.p. Varimag Drive installed on a proofing machine

- ★ Infinitely Variable Fingertip Speed Control
- ★ Standard Speed Range 20-1 or up to 150-1 for Special Applications
- ★ Manual or automatic, local or remote control of speed
- ★ Any Type of Motor Enclosure
- ★ Single or multi-motor drives
- ★ No external starting equipment required
- ★ No valves—no warming up time

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NR36

£18 Million Orders for Trans-Pacific Telephone Cable

ORDERS have been placed for the 8,700 nautical miles of newly developed submarine telephone cable and 335 submerged amplifiers required for the largest telephone cable project yet undertaken—the Commonwealth submarine telephone cable, which will span the Pacific linking Australia, New Zealand and Canada. This was announced last Monday by Mr. T. A. Housley, convenor of the Pacific Cable Management Committee.

This telephone cable project is being undertaken jointly by the United Kingdom, Canada, New Zealand and Australia. Control of the project has been vested in a Management Committee comprising one senior representative each from the Overseas Telecommunications Commission (Australia), Cable & Wireless, Ltd., the United Kingdom Post Office, the Canadian Overseas Telecommunication Corporation and the New Zealand Post Office.

The orders for the cable and submerged repeaters have been placed with Standard Telephones & Cables, Ltd., and Submarine Cables, Ltd. Their total value is approximately £18 million sterling. Under the conditions of contract, as much as possible of the raw material required for the cable is to be supplied from Australia and Canada.

The programme for the Pacific cable project provides for the Sydney-Auckland section to be laid first and made ready for service by July, 1962. Work has commenced on the terminal installations in Sydney and Auckland. Completion of the Pacific cable as a whole is scheduled for mid-1964. It will have a capacity of 80 high grade telephone channels. In addition to telephone service it will provide telegraph, phototelegraph, and telex circuits and facilities for leased private circuits for all types of telecommunications services and broadcast programme channels. It will connect, via Canada, with a similar cable to be laid this year between Canada and the United Kingdom, and will thus open up greatly expanded capacity and improved services between Europe and New Zealand and Australia.

The Atlantic and Pacific telephone cables represent the first two major links in the round-the-world Commonwealth telephone cable scheme which was recommended by the Commonwealth Telecommunications Conference in 1958, and has been approved in principle by the Commonwealth Governments. Individual links are being built as and when it is possible to finance and engineer them on a partnership basis between Commonwealth countries.

North-Western Export Club

North-western manufacturers who are anxious to help in the development of Britain's exports were joined by the President of the Board of Trade, Mr. R. Maudling, at the first meeting of a newly formed Export Club, in Liverpool last week. Mr. R. S. Redmond, managing director, Heyes & Co., Ltd., Wigan, who was elected to the chair, first urged the formation of the club at the recent North-western Export Round Table organised by the Federation of British Industries (Liverpool District). All the Round Table delegates and many other manufacturers from Lancashire, Cheshire, North Wales and the Isle of Man have joined the Club and were present at the inaugural meeting. The object of this informal club is to facilitate a continuous exchange of ideas among companies interested in exports.

FENNERS IN AFRICA

Last year Mr. S. B. Hainsworth, chairman of J. H. Fenner & Co. (Overseas), Ltd., announced that J. H. Fenner & Co. Africa (Pty.), Ltd., had been formed to provide for an expansion of the company's affairs and interests in the market. Since then negotiations have been completed for the acquisition by Fenner (Africa) of a controlling interest in an engineering company in the Johannesburg area which will be known as Fenner K.S.G. Manufacturing Co. (Pty.), Ltd., additions being made to its existing range of production. Associated in the new venture are Reunert & Lenz, Ltd., exclusive agents for Fenner products in South Africa.

J. H. Fenner & Co. (Overseas), Ltd., announce that Mr. J. Cleator, director and general manager, is now assisted by divisional directors in Mr. J. Perry for India, Mr. A. Bingley for Africa, Mr. J. Davies for the "Seven" and Mr. G. Munby for the "Six."

Borrowdale Inquiry

The Minister of Power is to hold a public inquiry on 14th February into a plan by the North Western Electricity Board to erect overhead lines in the parish of Borrowdale, Cumberland.

G.E.C. EXPORT WARNING

THE need for international agreement to enable longer periods of credit to be granted to under-developed countries was urged by Mr. Arnold Lindley, chairman and managing director of the General Electric Co., Ltd., in London on Monday. Unless there was a change in thinking about finance, orders for heavy electrical plant would continue to decline, he said.

Mr. Lindley, who was speaking at a Press conference to mark the fourth anniversary of the *G.E.C. Export Guide*, said that thinking about exports must become a natural habit of everyday business life. Since 1954 the sales of the G.E.C. overseas branches had increased by 70 per cent, but the proportion of direct exports from this country in these sales had declined from 46 to 34 per cent. The answer to local manufacture was to innovate and to expand exports of highly complex equipment that other countries could not make or could not make so well.

The importance of keeping a close watch on changing market conditions is brought home by the January issue of the *Guide*. This shows that although the outlook for British exports is generally good, prospects are deteriorating in six of the main Commonwealth countries.

REPORT ON BRITISH COLUMBIAN POWER SCHEMES

Further studies are to be carried out into two hydro-electric power schemes in British Columbia. At the request of the British Columbia Energy Board, Sir Alexander Gibb & Partners and Messrs. Merz & McLellan are to undertake an investigation into the cost of power generated from the Columbia and Peace Rivers, and the relative costs of electricity supplied to consumers from these two projects. Canada and the United States signed an agreement to develop the Columbia River last week, but the British Columbia Government favours the Peace River project. The British consulting engineers are not connected with either project and their report will be independent.

INDUSTRIAL NEWS *[continued*

Questions on Nationalised Transport

DURING talks last week with trade union leaders, the Minister of Transport (Mr. Marples) said that the Government did not intend to cut back the railway modernisation programme. Its plan was to examine existing projects and "sort out the good from the bad." One part of the modernisation plan which would be studied most carefully was the present mixture of diesel locomotion and direct electrification.

The trade union representatives are said to have argued that the Government should bear part of the cost of building the proposed Victoria Line extension to the London Underground. The Minister refused to commit the Government to financing the new tube, but he said that restrictions on private motoring in Central London should lead to more passengers being carried on public transport and the higher revenue might help to provide the money required.

PAY NEGOTIATIONS IN SCOTLAND

Discussions are proceeding between the Electrical Contractors' Association of Scotland and the Electrical Trades Union regarding a wage increase for electrical workers in Scotland, following the 1s an hour increase granted to electricians in England.

Agreement has recently been reached for the introduction of a 42-hour week in the radio, television and electronics industry in Scotland. The reduction of two hours is made without loss of pay and takes effect from the first full pay period commencing 1st February.

MORE COOKERS SOLD

A further rise in the number of electric cookers sold—the third in successive months—is shown in the latest return of domestic appliance sales by Area Electricity Boards issued by the Electricity Council. As will be seen from the accompanying table, the total for November was 32,563, an increase of 1,243 on the preceding month. Immersion heaters were in greater demand than in the corresponding month of last year though the sales figure was seasonally low, as was also the case with refrigerators.

BOARDS' DOMESTIC APPLIANCE SALES

Appliance	Month ended 30th November		Twelve months ended 30th November	
	Total	Change %	Total	Change %
Cookers ...	32,563	+ 3·2	340,895	+ 1·7
Water Heaters:				
Immersion ...	9,920	+21·9	191,354	+ 0·7
Storage ...	5,368	− 2·5	68,069	+13·6
Wash Boilers	4,463	−10·8	56,948	−16·5
Washing Machines ...	8,223	−35·7	117,022	−30·5
Refrigerators	5,677	+ 2·9	140,592	−15·6
Clothes Dryers	8,806	−25·4	62,318	n.a.

United Africa Co. Reorganisation

The United Africa Co., Ltd., announces that its overseas companies dealing with machinery and electrical equipment are being formed into a separate group which will include a company in London called United Africa Mechanical & Electrical, Ltd. ("Unamec"). This company will provide for its overseas associates, and for the rest of the United Africa group, buying and advisory services for machinery and engineering equipment, electrical supplies including radio and television, and refrigeration and air conditioning equipment of all kinds. The board of "Unamec" will have as executive directors Mr. R. McPherson (chairman), Mr. R. Gore-Clough and Mr. A. G. Pointon. Mr. J. G. Clark, Mr. R. H. Coleman and Mr. F. G. Gledhill will also be members.

Course for Wholesalers' Sales Representatives

THE Benjamin Electric, Ltd., held their fourth two-day course and conference for sales representatives of electrical wholesalers at their Tottenham Works on 18th and 19th January, those attending on this occasion being from the north of England. The course included demonstrations, lectures, and tour of the works and on the first evening those taking part were entertained to a reception and dinner at a London hotel followed by a theatre visit. At the conclusion of the conference Mr. H. G. Campbell, managing director, Benjamin Electric, Ltd., thanked the visitors for attending. Mr. R. Dibbo, of John Riley & Son (Electrical), Ltd., Sheffield, replied for the sales representatives.

Visit to Westool Works

Mr. Niall Macpherson, Parliamentary Secretary to the Board of Trade, recently went to the works of Westool, Ltd., St. Helen's Auckland, Co. Durham, in the course of a visit to North-Eastern England to inquire into local conditions of trade and employment. He is seen here (extreme left) talking to Mr. H. J. Boyden, M.P. for Bishop Auckland, Colonel C. E. Mackellar, director, Westool, and Mr. A. Hunking, managing director, Westool

Short Time at Refrigerator Works

The 1,200 production workers in the Luton refrigerator factory of Electrolux, Ltd., started a four-day week last Monday. The company stated that production had been maintained at a high level during the winter, but sales always dropped early in the year. The short time which was "short-term and temporary" was intended to prevent stocks from rising above the probable demand and the position would be reviewed monthly. The Electrolux suction cleaner factory is to continue to work a five-day week.

Chief Technical Assistants' Association

An address entitled "A Visit to Buenos Aires" will be given by Mr. L. H. Welch, O.B.E., B.Sc., M.I.E.E. (chief engineer, London Electricity Board), at the 1961 open meeting of the Chief Technical Assistants' Association. The meeting will be held at the British Lighting Council showrooms, Brettenham House, London, W.C.2, on 2nd February at 6.30 p.m.

Shinto Ceremony at Nuclear Site

TO mark the inauguration of the second stage in the building of the 150 MW nuclear generating station at Tokai-Mura, Japan, a Shinto religious ceremony was recently held on the site. This ceremony was arranged by Fuji Denki Seizo K.K., the principal sub-contractor to the British General Electric Company of Japan, Ltd. In addition to members of the various Japanese companies concerned in the project, those attending included Mr. Yoshida of the Japan Atomic Power Company, for whom the station is being built. The General Electric Co., Ltd., of England, was represented by Dr. H. K. Cameron, manager of the company's Atomic Energy Division.

During the ceremony, which was conducted by two Shinto priests, branches of a sacred tree were offered upon a specially constructed altar. Following this, Mr. T. Wada, chairman of Fuji Denki, cut a ribbon which acted as a signal for a papier-mâché sphere suspended between two concreting derricks to be pulled apart, thus releasing live pigeons and streamers which had been enclosed. Rockets were then set off containing parachutes which opened up to reveal scrolls covered with good wishes for the project. In conclusion a lorry carrying a skip of concrete was driven up to the altar where a crane lifted off the container and the concrete was poured.

Dr. H. K. Cameron, manager of the G.E.C. Atomic Energy Division, takes part in a Shinto religious ceremony to mark the inauguration of the second stage in the construction of the 150 MW nuclear power station at Tokai-Mura, Japan

NEWMAN EXPAND ELECTRONICS DIVISION

The Instrument Division of Newman Industries, Ltd., of Yate, Bristol, has been renamed Newman Electronics—Division of Newman Industries, Ltd. Announcing the change of name, Mr. Hedley Newman, assistant managing director, said that they were in the process of expanding the Division and the new title was more in keeping with the range of products.

Canadian Manufacturing Outlook

A further decline in sales by the Canadian electrical manufacturing industry in 1961 is forecast by Mr. J. Herbert Smith, president of Canadian General Electric Co., Ltd. Total sales in 1960, at $1,140 million, were 4·8 per cent less than in 1959. Employment has also continued to fall.

Sales of electrical consumer goods were down in 1960 and no substantial increase can be expected in 1961. Demand for electrical capital goods continues at a low level and demand for heavy equipment for power utilities is also relatively low. Mr. Smith foresees no significant improvement in 1961 for these products. Activity in the industry will pick up only as other business activity generates momentum, he says.

TRADE ANNOUNCEMENTS

British Insulated Callender's Cables, Ltd., announce that, as from 1st February, the eastern regional staff will be operating from premises at Friars Walk, Friars Place, Chelmsford, Essex (telephone: Chelmsford 58171/2). Stores will be established in the near future.

Mr. R. H. Hazlehurst has been appointed Midlands area representative of **Lumenated Ceilings, Ltd.** Until permanent office accommodation is available he will operate from the Birmingham Engineering and Exchange Centre, Stephenson Place, Birmingham, 2 (telephone: Birmingham Midland 1914).

The United Insulator Division of the **Telegraph Condenser Co., Ltd.,** have appointed Oswald King & Co., Ltd., 171, Gravelly Hill, Erdington, Birmingham, 23, as Midlands agents for their electrical ceramics (excluding "Unikote" ceramic coatings).

B. & K. Laboratories, Ltd., are again organising an international electronic instrument show at their Park Lane premises from 19th to 23rd June.

Aero Electronics, Ltd., Gatwick Airport, Horley, Surrey, have been appointed exclusive U.K. distributors for EDO (Canada), Ltd., the Canadian licensees of Burnell & Co., Inc., California, makers of variable inductors, toroids, delay lines and filters.

COLSTON DISHWASHER PROGRESS

Speaking at an informal function in London last week to mark the completion of the first year's marketing of the "Colston" dishwasher, Sir Charles Colston (chairman, Charles Colston, Ltd.) said that sales of the machine were progressing favourably. He claimed that in Britain sales already exceeded those of all other dishwashers combined. The company began to export about four months ago and it is expected that by the end of this year the total of their export business will be in the region of £750,000.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £186 0s 0d
COPPER, H.C. Electro	ton £220 15s 0d
Fire Refined 99·70%	ton £219 0s 0d
Fire Refined 99·50%	ton £218 0s 0d
COPPER Tubes ..	lb 2s 1⅞d
Sheet	ton £255 10s 0d
H.C. wire and strip	ton £271 15s 0d
LEAD, English ..	ton £63 5s 0d
Foreign	ton £62 0s 0d
MERCURY	flask £69 0s 0d
TIN, block (English) ..	ton £780 10s 0d
ZINC, G.O.B. Foreign	ton £78 5s 0d
BRASS Tubes (solid drawn)	lb 1s 9⅜d
Wire	lb 2s 7⅞d
PHOSPHOR BRONZE Wire	lb 4s 0⅜d
PLATINUM ..	oz £30 5s 0d
RUBBER, No. 1 R.S.S. spot	lb 23⅞d—24d

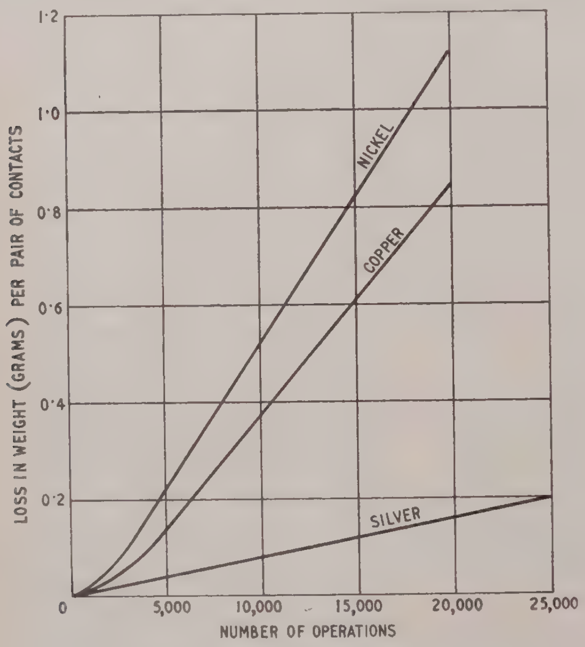
LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Contact Materials

MANY of your readers, especially those associated with electrical control gear, must surely be puzzled by the article on contact materials by M. M. Khalifa and F. Abul-Makarem in your issue of 30th December.

According to their Fig. 1, which, it is claimed, is based on experimental results, the order of the materials, in terms of their resistance to corrosion, is tungsten (best), platinum, molybdenum, nickel, steel, copper, silver, aluminium (worst). I would refer specifically to three materials in this list, namely, nickel, copper and silver. The results of tests using contacts of these materials fitted to a contactor and tested under similar conditions, are shown in the accompanying curve. The loss of weight in micrograms per operation is: silver, 8; copper, 46; nickel, 60. This is the reverse order to that given by the authors.



Test conditions 30 A, 380 V, 0·5 p.f. Contact force 9 oz.

Ratio $\frac{\text{closed period}}{\text{total period}} = \frac{1}{3}$. *500 operations per hour*

Silver contacts are widely used on small contactors in Great Britain and on the Continent, and it is unlikely that manufacturers would use this expensive material if, as Khalifa and Abul-Makarem imply, a cheap material such as steel is superior.

Perivale. H. W. BAXTER.

The following reply has been received from the authors who have been shown this letter:—

IT cannot be over-emphasised that contact erosion is a complex function of so many variables that any one formula cannot be applied to all conducting materials and over the whole range of current from fractions of one ampere used in some relays up to thousands of amperes handled by heavy duty circuit-breakers.

The grading list of materials given in the article complies with the experimental results of a number of investigators referred to in the article, and particularly agrees with the following grading list found by Wilson* in his experiments on "arc erosion," the phenomenon with which our article was concerned:—"Carbon (best), tungsten, molybdenum, nickel, iron, titanium, copper, silver, zinc, aluminium, tin (poorest)." Our proposed theory, as is made clear in the article, does not attack the problem of bridge metal transfer nor that of tarnishing of contacts due to repeated operation in certain atmospheres.

Although silver is superior to copper as a contact material regarding contact wear, as found by Mr. Baxter, and copper may sometimes behave better than nickel in the same connection, it is noticed that the tests by Mr. Baxter were made on repeatedly closed and opened contactors, thus including the effects of bridge metal transfer, that of tarnishing at 30 A, a much lower current than the thousands of amperes used by Wilson,* which would account for the different order of excellence obtained by Mr. Baxter.

Such characteristics of contact materials as affinity, tarnishing, contact resistance and mechanical properties are borne in mind when manufacturers favour the use of silver as a contact material.

Sometimes, the low contact resistance of silver and the high heat of evaporation of such material as tungsten are exploited by use of a sintered mixture of the two materials.

Cairo, U.A.R.

* W. Wilson, Trans. A.I.E.E., 74, 657 (1955).

Railway Signalling Lamps

IN this revision of the 1952 edition of B.S. 469 "Electric Lamps for Railway Signalling" the text has been rearranged to bring it into line as far as possible with other current British and international specifications for lamps. The list of lamps covered by the specification has been amended to meet present and future requirements and lamps whose use is preferred are indicated in heavy type. The range of lamps covered includes searchlight signals, multi-aspect colour light signals, position light junction indicators, repeaters and indicators and illuminated diagrams and control panels. As well as technical requirements, methods of test are laid down for determining the quality and interchangeability of the lamps. Since it is usually impracticable to test every lamp in a batch the standard calls for tests of samples. Quantities and quality levels are laid down.

Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 7s 6d.

VIEWS on the NEWS

By "REFLECTOR"

CHELTENHAM Rural District Council is one of the many bodies urging that electricity supplies should be afforded by underground cables instead of overhead lines. At a recent meeting it was resolved to ask the Rural District Councils Association

> "to oppose the practice of providing electricity supplies in rural areas on poles and pylons, especially in view of modern scientific developments which . . . had largely overcome the objections hitherto put forward by the Central Electricity Authority" (*Evesham Journal*).

I am not aware of any modern scientific developments which have reduced the cost of cables to the level of that of overhead lines and power transmission by radio methods has not yet reached a sufficiently advanced stage.

* * *

Compliments were paid to the salesmanship of the Yorkshire Electricity Board at a recent meeting of the North Eastern Gas Consultative Council. It seems to have been accepted that this was a principal reason for the erection of blocks of all-electric flats by some local authorities. The Council expressed concern at the exclusion of gas from these dwellings even if the tenants wanted it. One member made disparaging reference to "cuts" in electricity supply and another asserted that most people preferred gas for cooking. If the latter had said that most people *once* preferred gas for cooking he would have been more correct having regard to the way in which the sale of electric cookers has been catching up with gas cooker sales in recent times.

* * *

While on the subject of all-electric council dwellings I may refer to the Dunbartonshire County Council rents inquiry. A witness stated that for certain "luxury all-electric houses with underfloor heating" tenants were being charged a rent of 2s 10d a week. This certainly seems to be more than reasonable, but the position is spoilt for the poor tenants when the council expects 12s 6d a week for lock-up garages associated with the houses.

* * *

Emergency supplies of electricity from ships have sometimes been resorted to here and in the United States. Shortage of power in Norway has led to the adoption of the system for longer-term supplies. I am told by *Lloyd's List* that some Norwegian electricity supply undertakings and industrial concerns purchased or chartered T2 turbo-electric tankers for the purpose a year or two ago. It is now reported that recently two of these tankers have been chartered for supplying electricity to the Bergen peninsula and it is expected that a third will be needed this winter. The Sandnes electricity undertaking has chartered another vessel for five months but, it is said, the Stavanger Town Council has rejected a proposal to hire the *Beaver Dam*, one of the Canadian Pacific Railways' turbo-electric ships.

* * *

The Love Lane Christmas Pantomime, staged by the headquarters staff of the Merseyside and North Wales Electricity Board, must have been great fun. A report in the Board's journal, *Contact*, says that:—

> "Talent abounding graced the stage on the night in question, and a true pantomime it was. The prompter's desperate bellows from the wings added fuel to the flames of hilarity in the audience, and those in the know tell us that the pantomime behind the scenes had to be experienced to be believed."

* * *

Sir David Salomons, Bt. (vice-president and hon. treasurer of the I.E.E.), described in the *Electrical Review* of 30th January, 1891, his method of assessing lighting values. He said:—

> "For the want of a simple standard of 'brightness,' I employ the word 'intensity' as a comparative one. In the case of gas and the incandescent filament, the latter has a greater intensity than the former when burnt in the ordinary way. That is to say, any point in the incandescent carbon is brighter than any point in the gas flame. By 'diffusion' I mean absence of sharp, dark shadows. Small areas of light produce these, also comparatively large areas, if of great brilliancy. It is possible to obtain a simple expression for the value of diffusion. . . . To find practical values, I would suggest the following method. Having lighted an area—say, a room—in a manner which would please most people—not everyone, for this is to expect too much—the difference in light between the lighted and shadowed parts of the room must be ascertained. Suppose the ratio were to come out as 1 is to 10, then 0·1 or 10 will express a well-lighted room. The colour of the light enters somewhat into the problem, so that some function must be combined with it. I am about to give attention to this latter question, to find a simple method of investigation open to the uninitiated, without spectrum analysis in the usual sense."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. W. Hyland, M.Sc.Tech., M.I.E.E., A.M.I.Mech.E., has been appointed deputy manager of the Cardiff and East Central Area of the South Wales Electricity Board and **Mr. I. R. Lamb,** F.S.A.A., A.M.B.I.M., succeeds him as the Board's purchasing and stores controller.

Metal Industries, Ltd., announce the appointment of **Mr. R. J. F. Howard** as director of marketing. In this new post he will be primarily concerned with the co-ordination of the marketing activities of the electrical companies within the M.I. Group. Mr. Howard was previously a director of Lancashire Dynamo Electronic Products, Ltd. He remains a non-executive director of that company and also joins, in a similar capacity, the boards of five other M.I. subsidiaries—Brookhirst Igranic, Ltd., Lancashire Dynamo & Crypto, Ltd., Foster Transformers, Ltd., J. G. Statter & Co., Ltd., and Lancashire Dynamo Nevelin, Ltd. Before joining Lancashire Dynamo Electronic Products (then British Electronic Products) in 1947 as chief engineer, Mr. Howard was on the industrial electronic development staff of the English Electric Co., Ltd., and previously he was with Mullard, Ltd.

Mr. R. J. F. Howard

Mr. J. S. Clemo has been appointed to the board of the Benjamin Electric, Ltd. Since 1932 Mr. Clemo has been chief accountant of the company and he will retain that position in addition to his new duties.

Mr. J. S. Clemo

After eight years as advertising and sales promotion manager with Remington Rand, Ltd., **Mr. J. Mellor** has joined Sunbeam, Ltd., as marketing manager.

Mr. E. H. Joyce, who has been the publicity officer for the Electrical Engineers' Exhibition for the last two years, has joined Polyphon Public Relations, Ltd.

Mr. C. A. P. Cannon has been appointed to the board of Measuring Instruments (Pullin), Ltd., and at the same time becomes general manager. He has been with the company for 21 years.

Mr. C. A. P. Cannon

Some 130 employees and friends attended the annual dinner of the head office staff of the **London Electric Wire Co. & Smiths, Ltd.,** at the Dorchester Hotel, London, on 11th January. Dr. J. Aldington, chairman, presided, and in a speech responding to the toast of "The Company" made by Mr. J. R. Cox, technical director, stated that 1960 had proved a record-breaking year. Dancing and a cabaret followed.

Owing to ill-health **Mr. I. Hey** is relinquishing the chairmanship of Henry Simon (Holdings), Ltd., on 1st March but will remain a director of the company. He is to be succeeded as chairman by **Mr. D. T. Barritt,** who will relinquish his executive responsibilities and his appointment as joint managing director of Simon-Carves, Ltd., though remaining a director. Mr. Barritt has also been appointed deputy chairman of Simon Engineering, Ltd. **Mr. J. P. V. Woollam** becomes deputy chairman of Simon-Carves, Ltd., and **Mr. L. Brook** has been appointed a director and a member of the management board. **Mr. A. H. Bennett** has been appointed a director of Henry Simon (Engineering Works) and **Mr. J. G. MacLean** a director of Turbine Gears, Ltd.

Mr. J. Henderson, M.I.Mech.E., M.I.Prod.E., has been appointed general works manager of C. A. Parsons & Co., Ltd., in succession to **Mr. W. Winter,** who retired on 31st December.

Following the regrouping of the Marconi's Aeronautical Division in new premises at Basildon, Essex, the following staff changes have been made:—**Mr. F. Wheeler,** formerly sales and contracts manager, has been appointed deputy manager; **Mr. G. P. Parker** becomes manager, engineering co-ordination; **Mr. G. E. Beck,** chief engineer (navigational aids); and **Mr. L. R. Mullin,** chief engineer (airborne communications).

Mr. W. L. Watson, formerly works manager at the Northampton works of Pollard Bearings, Ltd., has now moved to the principal works at Ferrybridge in a similar capacity.

Mr. R. C. Mildner, M.Sc.(Eng.), M.I.E.E., A.M.Am.I.E.E., formerly research manager of the Telegraph Construction & Maintenance Co., Ltd., has joined the Plastics Department of the Dow Chemical Company, Midland, Michigan, as a technical specialist in dielectric insulation for power and communication cables.

The appointment of **Mr. C. W. Sadd** as general manager is announced by Oryx Electrical Laboratories, Ltd. Mr. Sadd was previously a director of the Leagrave Engineering Co., Ltd., and he has also held the position of works manager with Measuring Instruments (Pullin), Ltd.

Mr. C. W. Sadd

Mr. J. F. Douglas, M.Sc.(Eng.), A.C.G.I., D.I.C., A.M.I.C.E., A.M.I.Struct.E., has been appointed head of the Department of Mechanical Engineering at the Borough Polytechnic, London, in succession to **Mr. G. L. H. Bird,** who has taken up an industrial appointment.

Mr. F. D. Lowen has been appointed manager of the A.E.I. light power motor factory at Thorne, near Doncaster, of which he has been superintendent since 1953.

Mr. F. D. Lowen

Mr. W. Bruce, of Thorn Electrical Industries, Ltd. (Export Division), is leaving England on

6th February to visit Atlas lighting agents in Africa. He will visit Nigeria, Ghana, Sudan and Egypt.

Mr. A. W. Fisher, B.Sc., M.I.E.E., for many years London manager and local director of Higgs Motors, Ltd., is retiring on 31st March. Mr. Higgs was educated at King Edward VI Grammar School, Birmingham, and London University, receiving his practical training with the British Thomson-Houston Co., Rugby, and Willans & Robinson (now English Electric Co.). He joined Higgs Bros., predecessor of Higgs Motors, Ltd., in 1920.

Mr. A. W. Fisher

Mr. Ll. Young, M.I.Mech.E., M.I.Mar.E., M.Inst.F., has been appointed director of Bailey Meters & Controls, Ltd. As from 1st February he will become director of engineering and, in consequence, relinquishes the position of general manager.

Mr. Morley A. Griffith-Jones, O.B.E., has been appointed general sales manager of Chloride Batteries, Ltd. Before joining Chloride in December, 1959, he was sales director with the Burco-Dean group.

Mr. E. E. Cooper, A.M.I.E.E., at present a senior distribution engineer in the London Electricity Board's Regency District, has been appointed district engineer, Central District.

To mark his retirement from the chairmanship of Holophane, Ltd., **Dr. S. English,** F.Inst.P., was recently presented with a gold watch from the directors and senior staff. The presentation was made by the new chairman, Mr. H. G. Campbell. Dr. English, who joined Holophane in 1927 as head of the Technical and Research Department, is remaining on the board.

Mr. Campbell making the presentation to Dr. English (left)

The company also announces the retirement of **Mr. G. Dixon,** A.M.I.E.E., A.M.I.Mech.E., formerly sales executive responsible for Government contracts. He is succeeded by **Mr. W. H. Dodgson,** Dip.M.I.E.S., who has been with Holophane since 1954.

Mr. Peter E. M. Sharp, A.C.G.I., B.Sc.(Eng.), A.M.I.E.E., general manager of the Westrex Co., Ltd., has been appointed a director of the company.

Mr. W. M. Chapman-Walker, C.B.E., M.V.O., M.B.E., has been appointed a director of Aerialite, Ltd.

Mr. P. E. M. Sharp

Mr. James Winstanley, M.A., A.M.I.Loco.E., has been appointed general overseas manufacturing manager of F. Perkins, Ltd., with effect from 1st February.

OBITUARY

Mr. Harold D. Symons, chairman of H. D. Symons & Co., Ltd., died on 15th January in his eightieth year, after a short illness. Mr. Symons studied at the Finsbury Technical College under Professor Silvanus Thompson, and after initial experience in the cable industry joined the British Westinghouse Co., where he later worked with the late Sir Arthur Fleming on insulation development. He left British Westinghouse to become manager for the British interests of the Sterling Varnish Company of Pittsburgh, but the need for electrical insulating materials in the 1914-18 war led him to join Mr. Percy Good in founding the company which subsequently bore his name.

Mr. P. K. Davis, divisional electrical engineer, Eastern Division, C.E.G.B., died on 17th January at the age of 62. Mr. Davis received his technical education at Faraday House and from 1924 to 1948 he held posts with British Insulated Cables, Ltd., Messrs. G. V. Twiss & Partners, Messrs. Merz & McLellan, the Electricity Board for Northern Ireland and the Northmet Power Co. On nationalisation of the supply industry he was appointed senior assistant engineer (transmission) with the Eastern Division and was later promoted to transmission engineer. When the transmission and technical (electrical) work of the Division was amalgamated in 1959 he was appointed divisional electrical engineer.

Lt.-Col. G. S. Marston.—We regret to report the death, on 22nd January at the age of sixty-eight, of Lt.-Col. Gordon Spencer Marston, D.S.O., M.C., M.I.E.E., who until his retirement last February, when the group was merged with Metal Industries, Ltd., was the chairman and managing director of Lancashire Dynamo Holdings, Ltd. Col. Marston had been in the electrical industry for many years. He was educated at Cheltenham Grammar School and received his early training with Siemens at Stafford. After distinguished service in the Royal Engineers during the 1914-18 war he formed, with the late Mr. J. G. Statter, the well-known switchgear firm of J. G. Statter & Co., and when the business was acquired by the Lancashire Dynamo Group in 1956 he was chairman and managing director. He became a director of Lancashire Dynamo Holdings and he succeeded Mr. Stanley F. Steward (now director of B.E.A.M.A.) as chairman and managing director. Col. Marston leaves a widow and three married children to whom we extend our sympathy.

The late Lt.-Col. G. S. Marston

Mr. H. B. Mellor, Associate I.E.E.—The death occurred on 15th January of Mr. H. B. Mellor, of the Power Department, A.E.I. Birmingham district office. He was 55. Mr. Mellor joined the B.T.H. Leeds office in 1947 as a lighting engineer. In 1950 he moved to Birmingham as senior lighting engineer, Midlands, and four years later he was transferred from the Lighting Department to the Power Department. He was a past-chairman of the Leeds Committee of the Association of Supervising Engineers.

Mr. J. D. Coldwell, chief designer of Conveyancer Fork Trucks, Ltd., died on 12th January, aged 56.

Mr. J. W. Papworth.—The death occurred at Weston-super-Mare on 21st January of Mr. John Wyatt Papworth, A.M.I.E.E. He was 84.

Electricity Output in 1960

THE high level of electricity output in 1960 continued up to the end of the year, a notable feature being the steadiness of the rate of increase in recent months. The December statement of the Ministry of Power shows that, in the year as a whole, 118,849 million kWh was generated by the Central Electricity Generating Board, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board. This was 13 per cent more than in the previous year, the highest increase since the industry was nationalised in 1948.

The total does not, of course, include electricity generated outside the public supply system. Full figures for industrial supplies are not yet available, but up to the end of November 1,832 million kWh had been generated at the nuclear power stations of the United Kingdom Atomic Energy Authority, an increase of 76 per cent on the previous year.

The separate return issued by the Electricity Council shows that all twelve Area Boards achieved increases of upwards of 11 per cent, the highest rate being that of the Southern Board (17·4 per cent). Good progress was also made in the areas of the two Scottish Boards. Last year the North of Scotland Board generated 2,435 million kWh, of which 2,096 million kWh was produced at the Board's hydro-electric stations (14·2 per cent increase). In addition to imports of 469 million kWh from the Hydro Board, the South of Scotland Board received 995 million kWh from the Chapelcross nuclear power station (compared with 259 million kWh in 1959) and 207 million kWh from the C.E.G.B. (against 613 million in 1959).

ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Output capacity MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B. ...	5,095	68	534·6	11,570	19	11,601	10,925	26,771
North of Scotland H.E.B. ...	31	—	1·7	52	223	283	280	1,041
South of Scotland E.B.	391	3	1·9	727	48	775	733	1,763
Total for December, 1960 ...	5,517	71	538·2	12,349	290	12,659*	11,938	29,575
Corres. total for December, 1959	4,771	102	450·9	10,806	355	11,175	10,534	27,796
Inc. or dec., per cent	+15·6	−30·9	+19·4	+14·3	−18·2	+13·3	+13·3	+6·4
Total for 1960	50,421	882	5,296	116,158	2,537	118.849	111,884	
Total for 1959	45,350	1,148	4,193	102,861	2,174	105,168	98,941	
Inc. or dec., per cent	+11·2	−23·1	+26·3	+12·9	+16·7	+13·0	+13·1	

* The total figure includes generation by other methods amounting to 20 million kWh.

ELECTRICITY SENT OUT BY BOARDS FOR THEIR CONSUMERS

Board	Totals for December (million kWh)			Twelve Months' Totals Ended 31st December (million kWh)		
	1959	1960	Inc. or Dec. %	1959	1960	Inc. or Dec. %
London	920·1	1,051·7	+14·3	8,029·4	8,993·9	+12·0
South Eastern	618·6	732·6	+18·4	5,553·4	6,369·4	+14·7
Southern	804·8	969·4	+20·5	7,261·9	8,522·7	+17·4
South Western	368·2	424·7	+15·3	3,420·2	3,919·0	+14·6
Eastern	969·5	1,123·7	+15·9	8,821·2	10,131·7	+14·9
East Midlands*	773·2	860·1	+11·2	7,383·8	8,353·1	+13·1
Midlands*	1,030·9	1,155·4	+12·1	9,683·2	11,048·0	+14·1
South Wales*	513·0	553·5	+ 7·9	5,421·5	6,031·3	+11·2
Merseyside and N. Wales* ...	591·2	661·7	+11·9	5,733·6	6,484·1	+13·1
Yorkshire*	968·6	1,144·2	+18·1	9,314·2	10,892·9	+16·9
North Eastern*	559·4	625·7	+11·7	5,439·6	6,140·3	+12·9
North Western*...	1,004·0	1,128·2	+12·4	9,454·5	10,749·1	+13·7
Total all Area Boards	9,121·5	10,430·3	+14·3	85,516·5	97,635·5	+14·2
Direct Supplies by C.E.G.B. ...	328·3	334·1	+ 1·8	3,432·0	3,784·9	+10·3
Grand Total	9,449·8	10,764·4	+13·9	88,948·5	101,420·4	+14·0
Mainly Industrial Areas* ...	5,440·3	6,128·2	+12·6	52,430·4	59,698·8	+13·9
Mainly Non-Industrial Areas ...	3,681·2	4,302·1	+16·9	33,086·1	37,936·7	+14·7
South of Scotland E.B.	797·9	941·2	+18·0	7,139·1	8,052·3	+12·8
North of Scotland H.E.B. ...	182·6	210·7	+15·4	1,618·6	1,828·7	+13·0

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

RESEARCH AND DEVELOPMENT REPORT

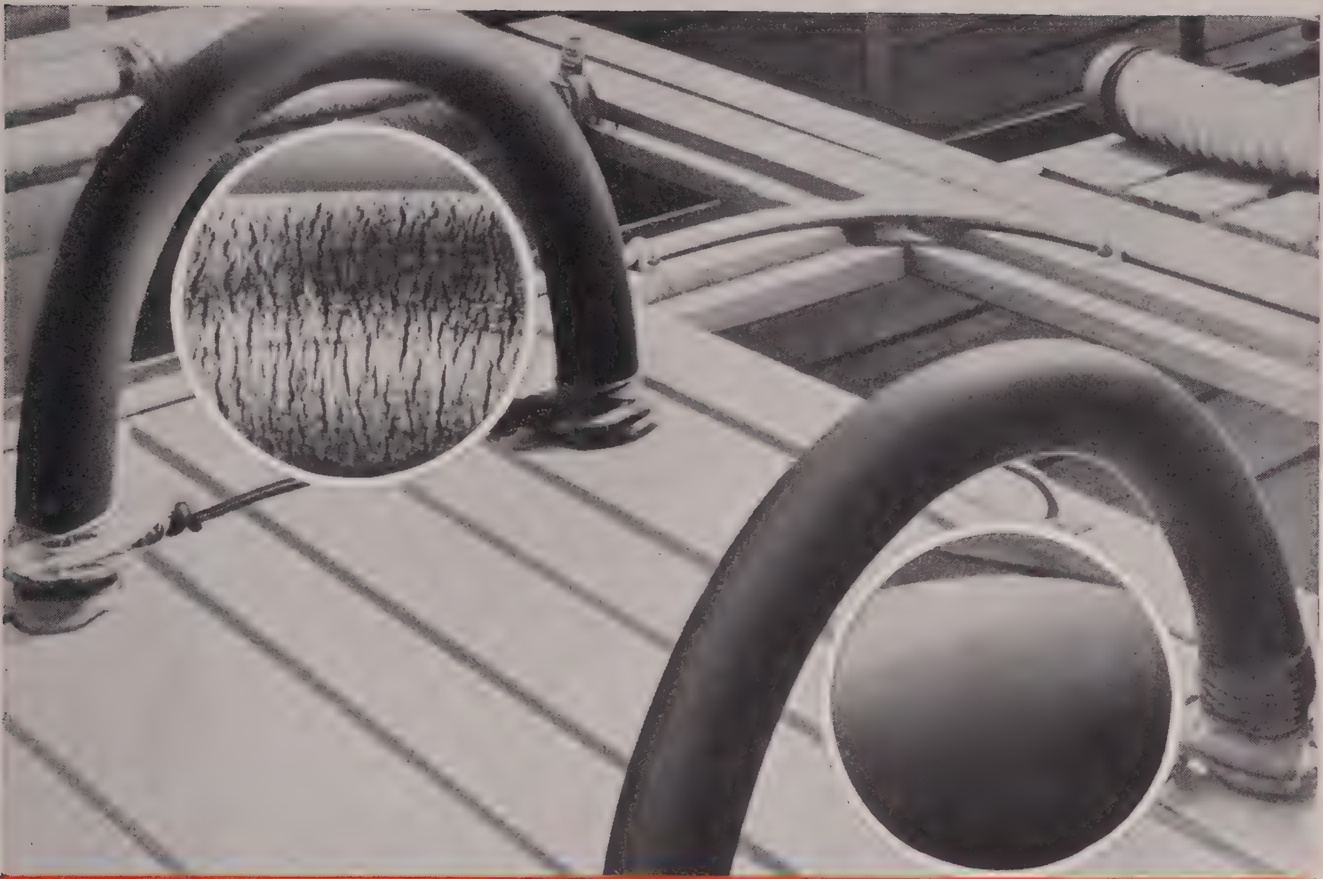
THE 11th annual report of the National Research Development Corporation published this week shows that in 1959-60 the Corporation's revenue increased, royalties and other payments amounting to £259,000 compared with £182,000 in the previous year. Expenditure on development during the year was £427,000 and the Corporation has entered into forward commitments for £739,000. The report states that some of the existing developments, fuel cells for example, may involve further large capital commitments.

New projects which the N.R.D.C. is sponsoring include electronic automatic plant and process control equipment using standardised units. The work is being undertaken by Elliott-Automation, Ltd., who are sharing the cost with the Corporation. Financial assistance is also being provided for some research by Professor D. Gabor, of the Imperial College of Science and Technology, concerned with the direct generation of electricity by thermionic means.

Projects which have continued satisfactorily include the Hydrox fuel cell developed by Mr. F. Bacon and the Carbox cell developed at the Sondes Place Research Institute, in addition to Atlas and Emidec 2400 high-speed computers. Support has also been given to work at Manchester University concerned with machines providing continuous speed variation of some two or three to one without slip rings, commutators or brush gear. During the year work has continued on three types of machine with the collaboration of two major electrical engineering firms who are undertaking their construction.

New Export Record

UNITED KINGDOM electrical exports in 1960 achieved a new record of £233·8 million, £2·5 million more than in 1959. This overall rise was, however, reflected in the totals of only one of the main groups of products, radio and electronic apparatus, exports of which, at £45·3 million, were £2·7 million higher than in 1959. Shipments of domestic electrical appliances, and particularly washing machines and refrigerators, were well above the 1959 level, and another important advance was recorded in exports of steam turbines.



CABLE JACKET OF DU PONT NEOPRENE IS STILL TOUGH AND LIVELY AFTER 24 YEARS

These photographs show test cables that have been fixed in a bent position under stress to increase their vulnerability to surface cracking. This exposure to outdoor wear over a period of 24 years proves the outstanding durability of Du Pont neoprene. See how the natural rubber jacket on the left has been cracked and weakened by the weather. The jacket made from Du Pont neoprene on the right, however, is still lively, resilient and tough.

Du Pont neoprene combines many properties that make it far superior to other jacketing materials. It has remarkable heat and flame resistance. It has excellent properties over a wide temperature range and can be compounded to remain flexible at –65° F. at the other extreme it has proved serviceable even upon brief, intermittent exposure to 500° F. Du Pont neoprene gives increased safety, too, because it will not propagate flame and it helps cut down the danger of fires.

Du Pont neoprene, in fact, offers balanced resistance to all the causes of deterioration—weather, sunlight and ageing; flame and ozone; oil and grease; many organic and inorganic chemicals; soil acids and galvanic action . . . as well as severe impact, abrasion and cutting. Ask your supplier about wire and cable jacketing made from Du Pont neoprene, and send the coupon below for a free copy of "What neoprene is—and how it protects wire and cable."

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ELECTRICAL REVIEW 1/61

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Please send copy of "What neoprene is—and how it protects wire and cable." *I am particularly interested in*.......................
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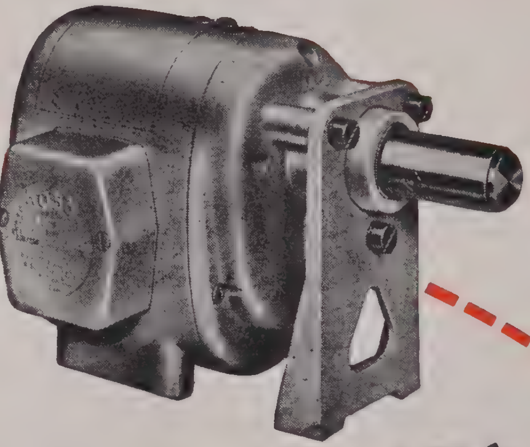
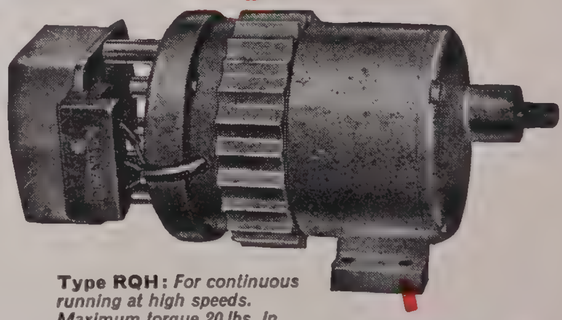
Type RQR: *Permanent capacitor geared motor for continuous running in either direction. Maximum torque 60 lbs. in.*



Type RQ53: *Similar to type RQR but for heavier duty. Maximum torque 150 lbs. in.*

- ✱ 270 standard speeds from 57 mins. per rev. to 2,700 revs. per min.
- ✱ Continuous running and reversing
- ✱ Built-in limit and programme switches

No other motors offer the wide range of speeds, torques and programme switching of the versatile Drayton RQ. Conforming to BSS 170/1939, the range includes motors for continuous or intermittent running, for reversing, with or without internal limit and programme switches, for multi-position switching or with a shaft rotation of more than one revolution before switching. There is a Drayton RQ motor to meet your requirement. Write for a copy of Data Sheet No. 302 TODAY.

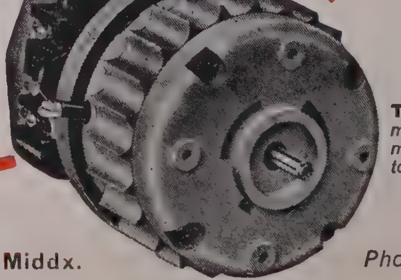


Type RQH: *For continuous running at high speeds. Maximum torque 20 lbs. in.*

Type RQU: *Shaded pole induction motor for the operation of valves and dampers. Maximum torque 40 lbs. in.*

Drayton

RQ MOTORS



Type RQG: *Gearless miniature capacitor induction motor with a maximum torque of 1.75 oz. in.*

RQ 15

Drayton Regulator & Instrument Co. Ltd., West Drayton, Middx. *Phone: West Drayton 4012*

Automatic Grading Machine for Germanium Wafers

By F. W. ROCKALL
A.M.I.E.E.*

The machine is capable of sorting germanium wafers into seven grades varying by 0·0002in thickness between each grade, at a rate of 1,200 per hour. The measurement is made by a "Magna Gage" electronic comparator

The heart of most semiconductor devices is a thin wafer of extremely pure germanium or silicon that has been cut from a single crystal of the metal. Many of the important characteristics of transistors and semiconductor diodes depend on the distance between the p-n junction layers and contacts that are formed on the faces of these wafers during manufacture. For example, in a high-frequency junction transistor designed to operate in the 10 Mc/s region, such as the G.E.C. type GET.872, the two p-n junctions should be about half of one-thousandth of an inch (0·0005in) apart and if this spacing varies by more than one ten-thousandth part of an inch (0·0001in) the characteristics of the device will be outside specification. For this reason all wafers used in G.E.C. transistors are measured and graded to this degree of accuracy before both the etching and alloying processes to obtain the necessary control of these processes.

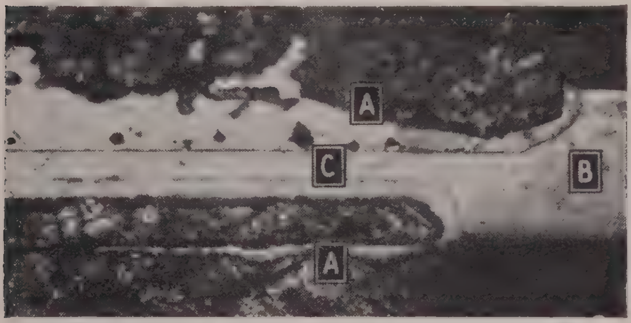


Fig. 1.—Section through part of a p-n-p transistor showing:
(A)—parts of indium hemispheres;
(B)—original wafer thickness; and
(C)—unalloyed layer of germanium

In a germanium transistor, the p-n junctions are formed by placing a small pellet of indium on each side of the wafer which, when furnaced, alloy with and penetrate into the germanium. The penetration required to achieve the spacing mentioned above is controlled by the use of indium pellets of accurate diameter and weight, and accurate measurement of the wafer thickness. The temperature of the furnace for the alloying operation is then adjusted according to the wafer thickness, a change of approximately 10°C being required for a thickness variation of 0·0001in. Fig. 1 shows a typical section through such a transistor.

The single crystal of germanium is first cut into slices, which are then lapped and cut into the small square wafers. The cutting processes damage the surface layers of the crystal wafers and this damaged material must be removed by a chemical etching process. The wafers are graded according to thickness before etching and the etching time is varied for each batch to bring the final thickness within the permissible limits, they are then graded again before they are sent for furnacing.

To achieve this accurate measuring and grading of large numbers of wafers at a relatively low cost and with the minimum of damage or contamination, the G.E.C. Semiconductor Division have developed an automatic wafer sorting machine which is currently measuring and grading wafers 0·1in square by 0·0047in to 0·0057in thick into seven grades varying by 0·0002in between each grade. These are handled at the rate of 1,200 per hour. Further machines under construction will be capable of sorting into a total of eleven similar grades.

The apparatus can be considered as six sections performing the functions of feeding, positioning, measuring, grading, sorting, and counting, which are driven or synchronised from a central camshaft.

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* Semiconductor Division, General Electric Co., Ltd.

In Fig. 2, motor (1) drives the camshaft (2) through spur gears (3), which were included to enable the speed of the machine to be varied for experimental purposes, and a friction clutch to avoid damage in the event of malfunction of the machine. A quantity of wafers is fed into a cylindrical hopper (5) inclined at 45°, the base of which is a rotating disc (6) having in its periphery eight square recesses of a depth to accept only one wafer each. The rotation of the disc is intermittent and derived from the camshaft via lever (7) and link (8) which oscillate a slider and rack (9). Thus the disc is rotated by one-eighth of a revolution for each cycle of the machine, to bring one of the recesses opposite to the outlet tube (10). On the return stroke of the rack and slider a small bellows (11) is operated.

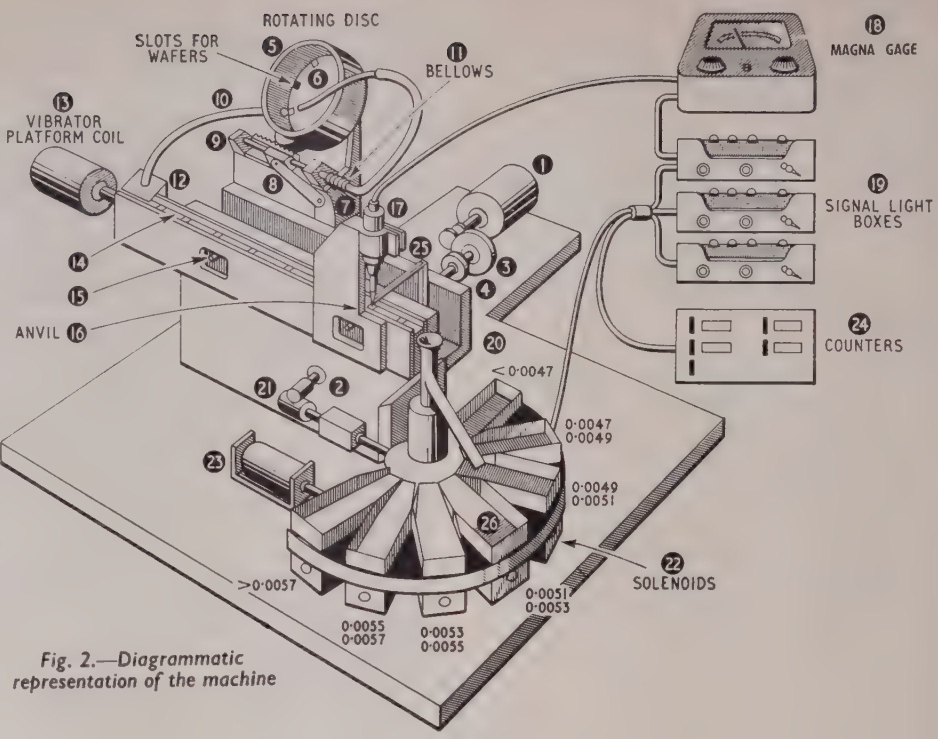

Fig. 2.—Diagrammatic representation of the machine

As the recesses in the disc pass beneath the bulk of wafers in the hopper they are, in the majority of cases, filled and, as they are carried up to the top and down to the outlet tube, any surplus wafers, or those not squarely in their recesses, slide down the face of the disc back into the bulk. When a recess is opposite the outlet a puff of air from the bellows carries the wafer into the tube.

Method of Measurement

The tube from the hopper carries the wafer on to a slightly sloping platform (12) at the end of the walking beam mechanism, where under the action of a small vibrator unit (13) it is turned square-on to the walking beam track. The walking beams (14) hardly warrant the name beams as they are only 0·020in thick and operate each side of a centre beam only 0·060in thick. The clearances between these parts and the side plates are very small and the walking beams are allowed to float in the small clearance provided, and are operated by two pins (15) which derive a rectilinear motion from the camshaft. The movement from the feed tube to the measuring anvil is accomplished in five stages and up to ⅜in of error in the feed position can be corrected so that the measurement is made in the centre of the wafer, at which point the all-important junctions will be formed.

The walking beams pass through the back of the yoke carrying the measuring probe and lower the wafer on to the measuring anvil (16); simultaneously the measuring probe (17) is lowered gently on to the wafer and the sorting signal of the previous wafer is cancelled by a cam-operated micro-switch. During the actual measurement the wafer is in contact only with the anvil and probe. The measurement is made by a " Magna Gage " electronic comparator (18) using a special probe exerting only 14 gm pressure on the wafer and it is lowered slowly to avoid damaging the wafer by impact. The measuring signal from the gauge is fed to a stack of three " Magna Gage " signal light boxes (19) which split the signal into the appropriate grades, and contain relays that make the circuit to the selected solenoid of the sorting unit; but the switching of the supply to the solenoids is slightly delayed by a cam-operated switch, so that any vibration from the solenoids does not affect the accuracy of the measurement. Later models are equipped with a " Parnum " gauge combining the gauging and sorting facilities in one instrument capable of sorting into 16 grades if necessary.

When the probe is lifted, the walking beams lift the measured wafer forward into the top of the sorting tube (20) and simultaneously bring the next wafer to the measuring anvil. The sorting tube rotates on a vertical shaft and the upper portion of the tube is concentric with this shaft, whilst the lower end of the tube is curved out to sweep over the sorting trays. The shaft and sorting tube rotate under the action of a coil spring concentric with the shaft and attached to its upper end, whilst the lower end of the spring is wound up by one revolution for every cycle of the machine, by a drive (21) taken from the camshaft.

An arm on the lower end of the sorting tube shaft engages with stops operated by the sorting solenoids: one for each grade (22) and a neutral position (23). During measurement, the rotation of the sorting tube is arrested by the neutral stop which is withdrawn when the supply is switched to the sorting solenoids. The tube rotates until stopped opposite the appropriate tray by the energised solenoid whilst the wafer is sorted, then continues to the neutral position when the sorting signal is cancelled as mentioned earlier. The supply to the solenoids is also connected to a bank of counters (24) which record the number of wafers in each tray and give an audible warning when the number reaches a pre-set figure suitable for the succeeding operation.

GLASGOW RAILWAY ELECTRIFICATION

MINISTRY OF TRANSPORT INTERIM REPORT

As a result of considerable public concern over the withdrawal of the Glasgow suburban electric trains after a number of incidents involving the electrical equipment, the Ministry of Transport have taken the unusual step of issuing an interim report on the investigations into the cause of the failures and the measures being taken to restore the service. The report records the intense efforts made by the railway authorities and the equipment manufacturers to deal with difficulties which might have been regarded as almost inevitable in some form when it is considered that in using multiple-unit trains with a dual high-voltage a.c. supply on an intense suburban service the British Transport Commission were pioneering in the field of electric traction. The lessons learned will be applied to future equipment to ensure that it is as reliable, safe and efficient as any in the world

In an interim report* on the inquiry into accidents which occurred last December to suburban electric trains in the Glasgow area of the Scottish Region of British Railways, the Ministry of Transport's Chief Inspecting Officer of Railways, Brig. C. A. Langley, states that investigations have shown the primary cause of the failures to be faulty design of the train transformers although they had passed all the tests laid down by the British Transport Commission including the appropriate requirements of British Standards. In the first of the two accidents forming the immediate subject of the inquiry an explosion shattered the equipment compartment in the guard's van of the train, injuring the guard and seven passengers. The second accident concerned a fire after a transformer cover had been burst open and was hanging down close to the track. This was the fifth transformer failure to have occurred since 30th October, when there was an explosion during a full day's trial held prior to opening the service on 7th November. An account of the inquiry was published in our 30th December issue.

Composition of Trains

The trains were made up of three-car units each comprising a driving trailer at the ends with a motor coach in the middle. This coach had a motor on each axle, and it carried the pantograph, mounted above the guard's van. The power equipment was carried below the floor of the coach, but the low-voltage switchgear and some other auxiliary equipment was in a closed compartment between the guard's van and the passenger compartment. The coaches were built by the Pressed Steel Company, Ltd., and the electrical equipment was supplied by A.E.I. (Manchester), Ltd.

The four-ton transformer had a rating of 970 kVA and was designed to take current through the primary winding either at 25 kV or 6·25 kV. The secondary winding had a rated voltage of 2,770 V and the tertiary 273 V. The current from the secondary winding was taken to four single anode pumpless air-cooled mercury arc rectifiers, with a continuous rating of 700 kW at 1,950 V d.c. output. Each pair of traction motors was fed through an iron-cored smoothing choke to limit the a.c. ripple in the d.c. motor current to 30 per cent at the continuous rating. The two chokes for the four motors were mounted in a tank on the underframe and cooled by the same system as the main transformer. The 210 h.p. motors were axle-hung with nose suspension, designed to operate on a rectified supply of 975 V with a current of 165 A with full field and 180 A with weak field.

The transformer primary comprised a cylindrical coil wound in four sections connected in series for 25 kV and in parallel for 6·25 kV by an electro-pneumatically operated off-load change-over switch mounted in an oil-filled chamber at one end of the transformer. This vessel did not form part of the oil circulating system but it was vented to the conservator tank through the same pipe as vented the transformer cooling oil. The secondary winding was in four concentric coils with appropriate oil passages round the central laminated steel core. It was provided with seven intermediate tappings of which one was the mid-point. All were designed to carry full load. The tap changer and the contactors were mounted in a cabinet fixed to the underframe. The tertiary winding comprised two coils in series, one at each end of the primary.

Oil Circulating System

The transformer was encased in a fabricated steel tank, 2ft 10in high, 2ft wide and 6ft 4in long and immersed in oil circulated at 50 gal/min. The oil pump was attached to the tank housing the smoothing chokes, from which oil was taken and forced into the top of the transformer tank. After passing through this it was drawn through an air-cooled radiator and returned to the choke tank. Part of the system was under a negative pressure having a maximum of about −6 p.s.i. in the choke tank, rising in the transformer tank to about +3 p.s.i. The conservator tank was mounted in the equipment compartment in the guard's van and connected to the top of the transformer tank by a $\frac{1}{2}$in diameter pipe. Originally the tank was vented to atmosphere through a silica-gel breather.

The auxiliary equipment compartment at the passenger saloon end of the guard's van was 18in deep and the width of the coach. In addition to the conservator tank it housed the low-voltage cupboard, containing fuses, cut-out switches, some fault indicators and relays, and a proportion of the auxiliary contactors and relays. The operating gear of the circuit-breaker projected into this compartment and the auxiliary compressor and certain compressed air apparatus for pantograph and circuit-breaker operation were housed in it.

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* H.M. Stationery Office, price 1s.

Transformer Failures

The report describes the various transformer failures in detail. After the initial mishap it was found that the secondary winding had been seriously overheated, the oil vaporising and building up a pressure until the conservator tank cover lifted, allowing the vapour to enter the equipment chamber. Since the ½in vent from the conservator tank was restricted to ⅛in diameter in the breather a 1in pipe was fitted to a plug hole in the top of the transformer tank venting direct to the atmosphere. Despite the fact that the contractor concerned had passed the 1in vent through the coach floor by connecting it to the existing ½in pipe, the modification was effective in preventing an explosion in the second incident, but when the explosion occurred on 13th December the pressure build-up was sufficiently fast to bulge the conservator tank cover, allowing gases to escape to the equipment compartment. The ventilation in this compartment was then improved to prevent the build-up of an explosive mixture. In the 17th December incident, however, the pressure build-up in the transformer tank was so rapid that the cover bolts sheared before the gas could escape through the vent. It was following this event that the trains were withdrawn from service.

Details are then given of the trial and service running up to this time—which amounted to a total of 481,253 miles with individual mileage for the affected sets between 3,939 and 7,614 miles—and the technical investigations which were carried out. Initially it was thought that the overheating was due to failure of the oil circulating system or prolonged overloading, the difference in the electrical and thermal characteristics between the primary and secondary windings and the chokes being sufficient to explain why neither the primary nor the chokes had suffered damage. A transformer unit complete with its oil system was subjected to a comprehensive series of tests, but the results discounted this theory. Admission of air to the system to induce an air-lock reduced the oil flow by about 75 per cent, when the secondary reached a steady temperature of 65°C with a current of 321 A, and with the oil pump stopped the temperature reached 69°C after 25 min. The specified maximum rise was 75°C, and it is stated that the paper insulation would not char until 150°C nor the oil vaporise below about 180°C.

A close examination of the transformer from the unit which suffered the explosion on 14th December again revealed damage confined to the secondary winding. The absence of general overheating and the localised burning on coils provided the first evidence that the thermal theory could be disregarded and that failure was due to a winding insulation breakdown from other causes. A study was then made of a "suspect" transformer in which the oil temperature had risen, operating the thermostat and tripping the circuit-breaker due to a fuse in the oil pump motor circuit blowing. The secondary of this showed serious displacement of the turns with "scuffing" of the paper insulation where over-riding of the turns had taken place. Had the insulation broken down the ensuing arcing would have resulted in "cracking" of the oil and the rapid build-up of gas pressure in the tank. The condition of the secondary indicated the presence of severe electro-magnetic forces and attention was concentrated on the electrical rather than the thermal problem.

There had been a period when there were frequent rectifier backfires—as a direct result of overheating due to defective ventilating arrangements—and some control gear failures which would subject the transformers to short circuit conditions. It was considered that these conditions, particularly the backfires, were sufficient to account for the winding displacement by electro-magnetic forces. Tests, although not conclusive, did not suggest that over-voltages had contributed materially to the failures. Proposals were made for modifying the transformers to increase their strength, for altering the circuits to reduce the forces on the windings and for an improved cooling system.

The redesigned transformer will be made up of a series of "pancake" coils of primary and secondary windings, interspersed in suitably disposed groups. The turns in each coil of the secondary will be stronger than those in the original winding. Although the difficulty with the rectifier ventilation has been corrected and the faults in the control equipment are being removed, occasional short circuits, backfires and motor flash-overs must be expected under service conditions of electric traction. Consequently, additional reactance will be included in the circuits to limit these abnormal currents, and additional arrangements will be made to limit the effect of voltage surges and to protect the circuits fed from the tertiary winding. In addition, the disposition of the transformer oil circulating pump will be changed so that the smoothing choke tank and radiator, like the rest of the system, are under a slight positive instead of a negative pressure. The size of the vent pipes from the transformer to the conservator tank and to atmosphere will be increased and, although not essential for safety, the conservator tank will be removed from the equipment compartment in the guard's van and placed on the outside of the coach. Although it is expected that trial running will begin in March, it may be some months before public services can be resumed since extensive trials will be carried out.

Report to Transport Commission

Brigadier Langley was assisted in this inquiry by Mr. F. J. Lane of Messrs. Preece, Cardew & Rider, a member of the Commission's panel of consulting engineers, and in his interim report to the B.T.C. he states that there was no evidence that the failures were due to any special conditions arising from the use of two supply voltages. An examination of multiple-unit train transformers supplied for a.c. electrification in other regions had shown them to be satisfactory, but all types would be subject to further tests when a suitable programme had been agreed.

A full report by Brigadier Langley is to be published later, covering all the factors affecting these accidents, whether technical or administrative. It will include particulars of the differences in the design and construction of the transformers made by various manufacturers, of the functioning of the various protective devices on the trains, including non-linear resistance units to discharge over-voltages from such parts of the equipment as the rectifiers and individual sections of the secondary winding, and it will consider to what extent the difficulties might have been averted.

NEW ELECTRICAL EQUIPMENT

Rechargeable Battery

A small cartridge-type battery capable of being recharged has been announced by Chilton Electric Products, Ltd., Hungerford, Berks. Known as the "Permabeam," it is a single unit some $4\frac{3}{4}$in long and of $1\frac{1}{4}$in diameter comprising a plastic case containing a series of nickel cadmium button-type cells. Normal battery contacts are provided and there is a two-pin plug enabling the unit to be inserted into a 100 to 240 V a.c. mains socket for recharging. A mains dropper resistor is incorporated with selenium rectifiers connected to give half wave rectification.

Chilton rechargeable battery

The battery should not be discharged to below 1 V per cell on load and preferably not below 1·1 V at the 10 hr rate. The maximum continuous discharge current should not exceed 220 mA, but for short periods of some seconds, double this current can be taken. The battery capacity at the 10 hr rate is 225 mAh. An average discharge voltage of 1·22 V/cell is maintained at the 10 hr rate. The charging rate during a 14 hr charge is 22 mA. These batteries will be available in four voltage ratings, with no variation in size. The standard model is 2·5 V, priced at 29s 6d, and other models are rated at 3·5, 5 and 6 V.

Universal Multi-Range Meter

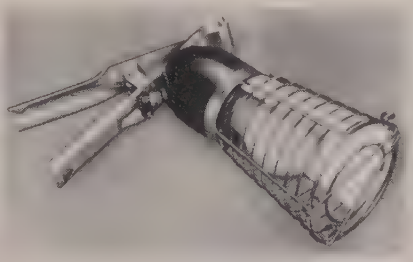
The portable Gossen meter Type UPHI recently introduced by Aveley Electric, Ltd., Ayron Road, Aveley Industrial Estate, South Ockendon, Essex, is a multi-range instrument designed for the measurement of a.c. voltage, real and reactive current, power factor, frequency, resistance, apparent phase-angle and reactive powers in the 40 c/s-4 kc/s range. The full-scale readings provided are 12-600 V, 60 mA-120 A, 1 Ω-100 kΩ multi-range, ±90° (cos Q sin Q) at 400 c/s and 4 kc/s, all with an accuracy within ±1·5 per cent up to 500 c/s, and 2 kc/s in the frequency scales. The meter has a moving coil movement with spring-loaded jewelled bearings. An internal 1·5 V battery is used as a power supply source for resistance measurements and a rotary potentiometer is used for zero setting. The price of the meter is £34.

Aveley Electric multi-range meter

Hand Lamps

The standard range of "Mazda" hand lamps produced by the A.E.I. Lamp & Lighting Co., Ltd., Melton Road, Leicester, has been replaced by two new models, the T2589, which has a strong leather sling, and the T2588, which is fitted with a spring grip handle.

Both types have a heavy insulated moulded body fitted with a cable clamp and a porcelain non-skirted b.c. lampholder. A wire guard is included for lamp protection and a removable eye-shield to prevent glare is fitted inside the guard. The wire guard is hinged to facilitate lamp replacement. They are priced at 18s (T2589) and £1 1s (T2588) each. Spare wire guards are available at 4s and spare b.c. lampholders at 5s each. Available extras include e.s. and heavy duty lampholders.



A.E.I. "Mazda" hand lamp fitted with a spring grip handle

Street Lighting Fitting

The "Sunstar Junior" lantern No. 695 for Group "B" street lighting announced by the Brighton Lighting & Electrical Engineering Co., Ltd., 35, Wellington Road, Brighton, incorporates cast-iron metalwork, and the light distribution is controlled by a prismatic two-piece bowl. The lantern is dust- and damp-proof and the gaskets used are treated against vermin and rot. A wide range of lamps up to 200 W g.l.s., 80/125 W mercury and 45 W sodium can be accommodated by a simply adjusted lamp bridge using the appropriate heavy quality porcelain lampholder which is fitted.

Dishwashing Machine

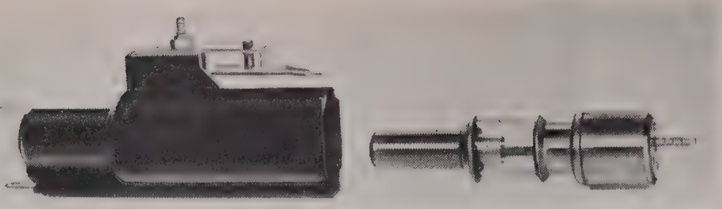
Extending their range of dishwashing machines, Kenwood Manufacturing (Woking), Ltd., Kenwood Works, Woking, Surrey, are now producing a fully automatic "Dishmaster" incorporating an electric water pump. This new machine, model A.471, needs no plumbing; all that is required is to connect a rubber hose to a water supply and place the

Fully automatic Kenwood "Dishmaster" model A.471 drainage hose in the sink. It has a centrifugal type pump system which is driven by a fan-cooled, shaded-pole motor.

The company have also introduced a modified version of their semi-automatic "Dishmaster" with a locking device which prevents the lid from being opened while the machine is in use and also works in reverse—no water can enter the machine while the lid is open. The prices of these "Dishmaster" machines, including purchase tax, are: Fully automatic, with pump, £133 7s; semi-automatic, standard model, £76 13s, and semi-matic, heater model, £96 12s.

Gas-tight Control Panels

The completion of a number of four- and two-gang gas-tight control panels intended for use where radioactive atmosphere, gases and fumes are to be excluded are announced by J. R. FERGUSON (ELECTRICAL ENGINEERS), LTD., Tameside Works, Park Road, Dukinfield, Ches. These panels are of 15 A capacity, and the gas-tight feature is obtained by the use of Ethox epoxide resin mouldings, in which components from standard 15 A plugs and sockets are employed. The adhesion of epoxide resin to metal conductors renders it virtually impossible for radioactive atmosphere and gases to percolate along the conductor lengths.



B. & R. Relays vacuum switch

Vacuum Switch

The vacuum switch type 183 announced by B. & R. RELAYS, LTD., Temple Fields, Harlow, Essex, may be supplied separately or complete with a plastic housing when it is then designated type 85. The switch is of compact design and is capable of switching inductive loads of up to 2 kW at voltages ranging up to 3,000 V. A reliable contact make is always guaranteed, even with very low voltages and very infrequent operation, as the point of contact is protected against all forms of contamination. It is used for switching h.t. voltages in radio installations, fluorescent tubes, medical apparatus, and also for generating ignition voltages in temperature regulators. Up to four type 85 switches may be fitted to the d.c. type C.12 and the a.c. operated type C.62 relay. The coil in this has a maximum nominal power of 6 W or 20 VA and a maximum resistance of 12,000 Ω.

ELECTROLUX REFRIGERATORS FOR 1961

WITH the introduction of the new model L.40, the Electrolux range of refrigerators for this year is increased to seven models, in sizes from 1½ to 7½ cu ft. The new refrigerator, like others in the range, is of the absorption type. The capacity is 4 cu ft with 8 sq ft of shelf area and its low-temperature compartment accommodates 7 lb of frozen food—most types of which can be kept safely for at least three weeks. Two ice trays provide 1 lb 5 oz of ice. There is a cold tray for storing uncooked meat and fish and, for keeping salad, vegetables and fruit crisp and fresh, the refrigerator has an easily removable full-width drawer. The door is planned for easy storage and has two special compartments for butter and cheese. Three adjustable shelves accommodate bottles, small packets, etc., and milk and wine bottles can be stored on the lower shelf. All shelves can be removed quickly for cleaning.

The overall dimensions of the cabinet are 36in high by 22⅞in wide by 24½in deep and the finish is in white or cream. The price is £52 3s 4d plus £9 15s 8d purchase tax. A tray top is an optional extra at £2.

A completely new version of the popular model L.26 2·6 cu ft refrigerator, the De Luxe 26, is also announced. It has a fully enclosed low-temperature storage compartment which accommodates up to 3¾ lb of frozen food for up to three weeks. The finish is in white or cream enamel with colour decoration in ice-blue and gold and it is equipped with a new type door catch with a "featherlight" closing action, and a chromium plated door handle. It measures 31⅞in high by 20¾in wide by 23¾in deep and the price is £41 11s 2d plus £7 15s 10d tax.

The price of the model L.26 refrigerator has been reduced from £47 17s 5d (including £7 11s 2d purchase tax) to £45 3s (including £7 2s 7d purchase tax). A limited number will continue to be available, in cream only, during the early part of 1961 and dealers holding stocks of this model are being reimbursed for the difference in price.

Two of the latest Electrolux refrigerators, model L.40 (left) and the De Luxe 26 (right)

NEW Dubilier Power Factor Correction Capacitors for fluorescent street lighting.

Dubilier Duconol Power Factor Correction Capacitors for fluorescent street lighting are subjected to stringent testing to ensure absolute reliability. These capacitors are sturdily built, hermetically sealed, completely leakproof and are suitable for satisfactory use at their rated voltage up to temperatures of 70°C thereby reducing maintenance cost to the absolute minimum.

For full details of the wide range of sizes and specifications, please write to:

DUBILIER

Dubilier Condenser Co. (1925) Ltd.,
Ducon Works, Victoria Road,
N. Acton, London, W.3.

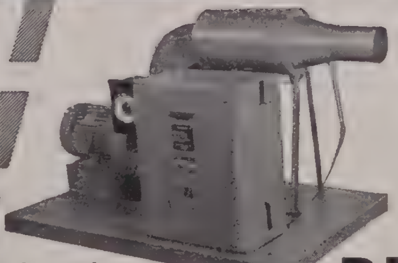
Tel: ACOrn 2241 (5 lines) Grams: Hivoltcon London Telex. Telex: 25373 Cables: Hivoltcon London.

Speed up YOUR production economically with SECOMAK

HIGH PERFORMANCE BLOWER & SUCTION UNITS

There's plenty of High velocity air for industrial purposes with Secomak blower and suction units in a variety of capacities. Light in weight and compact the model illustrated measures only 12″ square × 20″ high and is powered by continuously rated A.C. induction motor but it has a capacity of 300 C.F.M. at 17″ w.g. to 100 c.f.m. at 27″ w.g.

Send for Range and Data Sheets Nos. 104, 132, HV. 100



Courtesy of D. Napier & Son Ltd.

HOT AIR BLOWERS

Increased efficiency is assured with 'Secomak' Hot Air Blowers in many industrial processes requiring heat for drying or conditioning. Transportable model illustrated incorporates fan delivering 750 c.f.m. and heater loadings up to 18 kW with automatic temperature control.

Hot Air equipment from units weighing only a few pounds complete with blower, in a wide practical range.

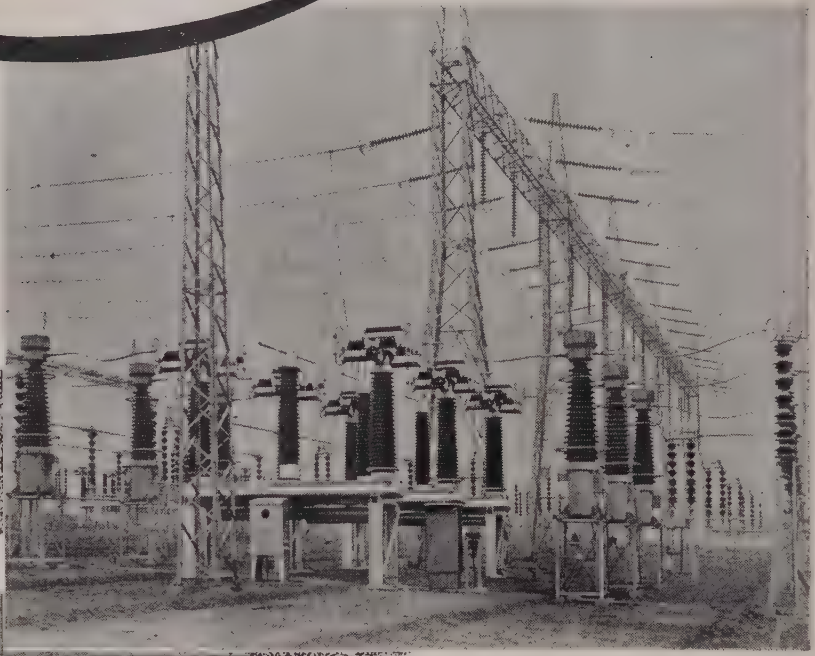
Send for Data Sheet No. 130/60

SERVICE ELECTRIC CO. LTD. HONEYPOT LANE · STANMORE · MIDDX. EDGware 5566/9

The *first* 330-kV SWITCHGEAR IN AUSTRALIA

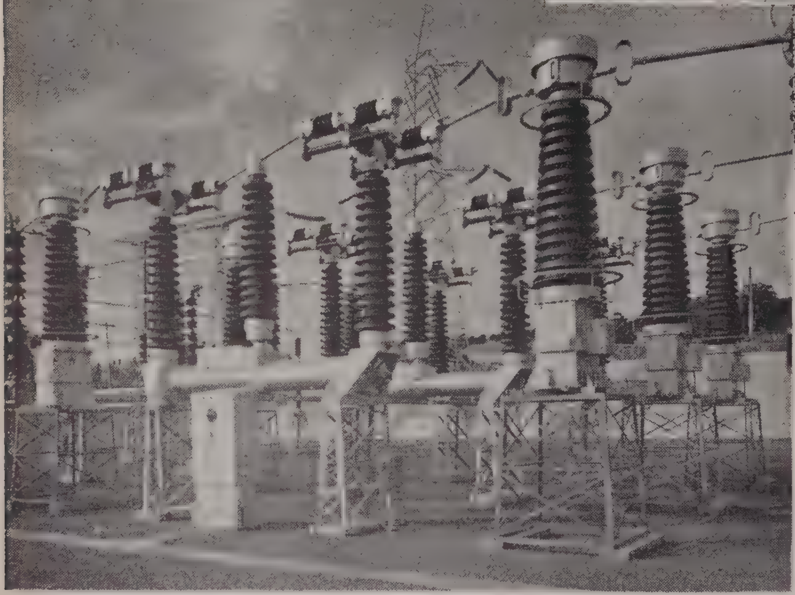
330 kV

at Upper Tumut (Snowy Mountains H. E. Authority), Yass. (E.C. New South Wales), and Yallourn (S.E.C. Victoria)



275 kV

at Magill and Port Augusta, S. Australia (Electricity Trust, S. Australia)



The first switchgear with a rating of 330kV 10,000 MVA to be commissioned in Australia was constructed by AEI.

From the Upper Tumut Generating Station, supply is distributed through the Yass Switching Station into the N.S.W. system. Air-blast circuit-breakers of the type GA11W8 are employed.

At the Magill Sub-station and the Sir Thomas Playford power station, Port Augusta, in South Australia, type GA10X8 air-blast circuit-breakers, with a rating of 275kV 3,500MVA, are installed.

Further switchgear of this type, for 330kV service, will be installed at the Sydney South Sub-station.

Photographs by courtesy of Electricity Supply Commission, New South Wales and Electricity Trust of S. Australia.

For further details, write to AEI Switchgear Division, Trafford Park, Manchester 17, or to your local AEI office

AEI Associated Electrical Industries Ltd.

Switchgear Division

TRAFFORD PARK, MANCHESTER · HIGHER OPENSHAW, MANCHESTER · WILLESDEN LONDON

F/A019

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1949

4870. United Kingdom Atomic Energy Authority.—Nuclear fuel elements. 17th February, 1950. (859940.)

1955

33312. Newton, F.—Carbon pile electric regulators. 13th February, 1957. (860541.)

1956

4879. Associated Electrical Industries, Ltd.—Earth leakage protection systems for electrical circuits. 8th May, 1957. (860430.)

5635. Henley's Telegraph Works Co., Ltd., W. T.—Insulated electric cables. 13th February, 1957. (859559.)

6735. Electric & Musical Industries, Ltd.—Electrical phase shift networks. 4th March, 1957. (859942.)

7021. Associated Electrical Industries, Ltd.—Electrically driven hoists, winders and the like. 26th February, 1957. (860431.)

7707. South Wales Switchgear, Ltd., and Hall, H. A.—Electric switches. 3rd May, 1957. (859875.)

8475. Mettoy Co., Ltd.—Electric motors and articles incorporating electric motors. 19th March, 1957. (859560.)

10974. Electric & Musical Industries, Ltd.—Colour television. 11th April, 1957. (860341.) 11252. Colour television receivers. 12th April, 1957. (860223.)

12941. Electric & Musical Industries, Ltd.—Waveform gating circuits. 29th April, 1957. (860225.)

14807. English Electric Co., Ltd.—Nuclear reactors. 8th May, 1957. (859811.)

14854. Electric & Musical Industries, Ltd.—Magnetic core storage devices. 13th May, 1957. (859944.)

16848. E.M.P. Electric, Ltd.—Electric protective equipment. 28th May, 1957. (859378.)

19583. International Computers & Tabulators, Ltd.—Electrical signal storage arrangements. 21st May, 1957. (859565.)

22490. Plessey Co., Ltd.—Cam-operated electric switches. 15th July, 1957. (860783.)

24772. British Ceramic Research Association.—Titanate materials suitable for dielectrics in ceramic capacitors. 9th August, 1957. (860019.)

25980. Associated Electrical Industries, Ltd.—Magnetic amplifier circuits. 15th August, 1957. (859411.)

28357. Associated Electrical Industries, Ltd.—Apparatus for the testing of semiconductors. 16th September, 1957. (860433.)

33923. Hargreaves, B.—Automatic electric circuit-breakers. 30th January, 1958. (860784.)

36336. English Electric Co., Ltd.—Multiway fluid selector valves. 22nd November, 1957. (859505.)

1957

2127. Fairbanks, Morse & Co.—Electrical force measuring systems. 21st January, 1957. (859431.)

5239. Philips Electrical Industries, Ltd.—Devices for the selection of electric pulses according to their heights. 15th February, 1957. (860181.)

5821. English Electric Co., Ltd.—Nuclear reactors. 14th February, 1958. (859471.)

6210. Plessey Co., Ltd.—Manufacture of electrical capacitors. 25th February, 1958. (860533.)

6380. European Research Associates S.A.—Preparation of transparent electrically conductive layers. 26th February, 1957. (860566.)

7740. Westinghouse Air Brake Co.—Electrical remote control systems. 8th March, 1957. (860589.)

9356. Siemens-Schuckertwerke A.G.—Electric current supply installations employing rectifiers to feed a load. 21st March, 1957. (860828.)

10925. General Electric Co., Ltd.—Semiconductor devices. 28th March, 1958. (859849.)

11514. Minister of Aviation.—Electrical sequence switches. 4th July, 1958. (860438.)

12423. Philips Electrical Industries, Ltd.—Voltage amplifying devices. 16th April, 1957. (859986.)

13582. D. Napier & Son, Ltd.—Electrical resistance heating elements. 24th April, 1958. (860196.)

13879. Reyrolle & Co., Ltd., A.—Electric relays of the induction type. 1st May, 1957. (860535.)

13892. Philips Electrical Industries, Ltd.—Methods of manufacturing magnetically-anisotropic permanent magnets having a crystal texture. 1st May, 1957. (860127.)

14340. Amp, Inc.—Insulation piercing crimped connections for electric conductors. 6th May, 1957. (860262.)

14964. Micklethwait, E. W. E. (Garrett Corporation).—Automatic electric control apparatus. 10th May, 1957. (860227.)

17031. Rank Cintel, Ltd.—Apparatus for detecting ferromagnetic and electrically conducting objects. 29th May, 1958. (860197.)

17165. Telefunken G.m.b.H.—Electrical apparatus operable from an a.c. supply or a battery. 30th May, 1957. (860383.)

17411. Associated Electrical Industries, Ltd.—Electric cable terminations. 28th May, 1958. (859443.)

17555. Black Automatic Controls, Ltd., and Black, A.—Pressure responsive electric switches. 3rd June, 1958. (860759.)

18484. Standard Telephones & Cables, Ltd.—Electron discharge device. 12th June, 1957. (860230.)

18832. Soc. le Carbone-Lorraine.—Impregnated carbon brushes for electrical machines. 14th June, 1957. (860409.)

19009. Lindly & Co., Inc.—Photoelectric system. 17th June, 1957. (860270.)

19305. Philips Electrical Industries, Ltd.—Electric discharge tubes. 19th June, 1957. (859778.)

19813. Soc. Générale de Constructions Electriques et Mecaniques Alsthom.—Control of electric motors driving sections of a plant for carrying out a continuous process. 24th June, 1957. (859669.)

20120. United Kingdom Atomic Energy Authority.—D.c. polarographs. 30th May, 1958. (860130.)

20187. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Pressure vessels. 18th June, 1958. (860190.)

21232. Solartron Electronic Group, Ltd.—Electronic apparatus for reading symbols. 27th June, 1958. (860568.)

23855. Griffith, A. A.—Nuclear reactors. 30th August, 1948. (859494.)

24526. United States of America Atomic Energy Commission.—Nuclear reactor control rod. 2nd August, 1957. (859548.)

24872. Standard Telephones & Cables, Ltd.—Magnetic storage devices. 1st August, 1958. (859704.)

26265. Rauland Corporation.—Thermionic cathodes. 20th August, 1957. (860388.)

27550. Netherlands Director General of Posts, Telegraphs and Telephones.—Impulse receiver. 2nd September, 1957. (860004.)

27748. Square D Co.—Electric motor control arrangements. 3rd September, 1957. (859412.)

28367. Krizik-Karlin Vyvojovy Zavod Narodni Podnik, Tomanek, E., and Polacek, A.—System for measuring the supply or consumption of d.c. 9th September, 1957. (860481.)

28699. Ketay, Ltd.—Electrical synchronising devices. 17th November, 1958. (860120.)

28771. Soc. d'Electronique et d'Automatisme.—Electronic switching devices. 12th September, 1957. (860685.)

29292. Siemens-Schuckertwerke A.G.—Electric circuits for regulating the supply of d.c. loads. 17th September, 1957. (859473.)

30521. International Business Machines Corporation.—Apparatus for detecting magnetic fields utilising the Hall effect. 30th September, 1957. (860200.)

30538. Philips Electrical Industries, Ltd.—Methods of manufacturing permanent magnets. 30th September, 1957. (860128.)

30549. Associated Electrical Industries, Ltd.—Examination of electrical waveforms. 7th November, 1958. (860005.)

31836. Pensabene, N.—High frequency alternators. 13th October, 1958. (860687.)

33378. Telefunken G.m.b.H.—Correction circuit for signals in a wide frequency band. 25th October, 1957. (860201.)

36259. Brookhirst Switchgear, Ltd.—Multi-unit electric contactors. 7th November, 1958. (859625.)

36796. Rank Cintel.—Arrangements for producing periodically varying currents. 25th November, 1958. (860808.)

38569. Holzer, W.—Electrical time switches. 11th December, 1957. (859389.)

40281. L. G. Hawkins & Co., Ltd.—Clothes dryer. 30th December, 1958. (860208.)

1958

3054. Hargreaves, B.—Temperature responsive electric switches. 30th January, 1958. (860785.)

3562. T.I. (Group Services), Ltd.—Production of irradiated polymer coated electric cable. 4th May, 1959. (860811.)

4497. Monroe Calculating Machine Co.—Electrical binary divider. 11th February, 1958. (860852.)

5051/2. General Electric Co., Ltd.—Photo-conductive devices. 16th February, 1959. (860393/4.)

5203. General Electric Co., Ltd., and Pearson, F.—Methods and apparatus for high frequency induction heating. 18th February, 1959. (860853.)

6171. National Research Development Corporation.—Electron discharge devices. 18th February, 1959. (860551.)

9112. Standard Telephones & Cables, Ltd.—Power cables. 20th March, 1959. (860648.)

9561. British Insulated Callender's Cables, Ltd.—Paper for use in the manufacture of electric cables and capacitors and other purposes. 24th March, 1959. (860821.)

9592. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Shock absorbing devices. 10th April, 1959. (860691.)

9727. British Insulated Callender's Cables, Ltd.—Electrically insulated conductors. 25th March, 1959. (860773.)

9750. Sylvania-Thorn Colour Television Laboratories, Ltd.—Assembly of semiconductor devices. 26th June, 1959. (860395.)

10034. Elesta, Ltd.—Glow discharge tubes and circuits therefor. 28th March, 1958. (860122.)

11435. Bruce Peebles & Co., Ltd., and

(*Continued on page* 188)

Higgins, L. J.—Limit switching apparatus. 9th April, 1959. (860396.)

11847. General Electric Co., Ltd.—Apparatus for effecting amplitude compression or expansion of electric signals. 14th July, 1959. (859602.)

15116. Nuclear Power Plant Co., Ltd., and Carr, F.—Tubular heat exchangers. 17th April, 1959. (860139.)

15669. General Electric Co., Ltd.—Electric resistance welding apparatus. 15th May, 1959. (860776.)

15876. Macchioni, P. A., and Macchioni, L.—Electromagnetic hammers. 16th May, 1958. (860777.)

16286. Pritchett & Gold & E.P.S. Co., Ltd.—Lead-acid type electric accumulators. 8th May, 1959. (860211.)

16492. Soc. des Accumulateurs Fixes et de Traction.—D.c. power supply devices. 22nd May, 1958. (860780.)

18683. Associated Electrical Industries, Ltd.—Apparatus for measuring the thickness of electrically conducting films. 9th June, 1959. (860399.)

19632. General Electric Co., Ltd.—Lighting fittings. 14th September, 1959. (860140.)

20512. General Electric Co., Ltd.—Circuit arrangements for operating electric lamps. 9th June, 1959. (860107.)

21691. Mullard, Ltd.—Voltage reference tubes. 7th July, 1958. (860540.)

22354. Evershed & Vignoles, Ltd.—D.c. amplifiers employing transistors. 6th July, 1959. (860725.)

22988. Associated Electrical Industries, Ltd.—Semiconductor diodes. 3rd July, 1959. (860400.)

23018. Etablissements Davey Bickford Smith & Cie.—Insulating socket for connecting electrical conductors. 17th July, 1958. (860473.)

23333. Associated Electrical Industries, Ltd.—Electric lighting fittings. 6th July, 1959. (860720.)

25148. Frachon, M.—Time switches controlling electric circuits. 6th August, 1958. (860042.)

25494. Baldwin, A. W.—Electrical heating elements. 6th August, 1959. (860213.)

26847. Racal Engineering, Ltd.—Bi-stable transistor circuits. 13th August, 1959. (860143.)

27557. Egen Electric, Ltd., and Bowman, A.—Low-frequency amplifiers for stereophonic sound reproduction and to potentiometers therefor. 9th November, 1959. (860134.)

28242. Automatic Telephone & Electric Co., Ltd.—Printed circuit cards. 10th August, 1959. (860358.)

28567. Philco Corporation.—Electrical systems. 5th September, 1958. (860521.)

31205. Associated Electrical Industries, Ltd.—Encapsulation in irradiated polysiloxane. 12th August, 1959. (860364.)

31515. Brown, Boveri & Cie. A.G.—Contact device for the direct electrical resistance heating of metallic bar-shaped bodies. 2nd October, 1958. (860855.)

32293. A.E.I.-Hotpoint, Ltd.—Electric immersion heaters. 23rd September, 1959. (860743.)

33662. Sylvania Electric Products, Inc.—Filament transfer device. 21st October, 1958. (860203.)

33936 and 33938. Westinghouse Electric Corporation.—Circuit interruptors. 23rd October, 1958. (860245/6.)

34303. Robinson Machine Works, Inc.—Means for interlocking electrical connector casings. 27th October, 1958. (860475.)

35230. Associated Electrical Industries, Ltd.—Transistor circuits. 10th November, 1959. (860367.)

36011. British Telecommunications Research, Ltd.—Devices for and methods of sealing electric cables. 9th November, 1959. (860048.)

36580. London Electricity Board, and Townsend, J. W.—Time interval measurement. 12th November, 1959. (860094.)

38156. London & Overseas Freighters, Ltd., and Mackenzie, E. A.—Electrical generating systems for motor ships. 23rd November, 1959. (860575.)

38506. A.E.I. Lamp & Lighting Co., Ltd.—Lighting fittings. 24th November, 1959. (860619.)

39761. United Kingdom Atomic Energy Authority.—Gas discharge apparatus. 10th December, 1958. (Divided out of 860231.) (860232.)

1959

1302. United-Carr Fastener Corporation.—Electrical circuit connectors. 13th January, 1959. (859648.)

2535. Soc. Gram-Electric.—Device for protecting electrical generating plant against the effects of short-circuits. 12th April, 1957. (860607.)

8904. Electrical Instrument Co. (Hillington), Ltd.—Moving coil instruments. 14th March, 1959. (860415.)

9534. Westinghouse Electric Corporation.—Electric circuit interruptors of the single bushing type. 19th March, 1959. (859866.)

12208. Forges et Ateliers de Constructions Electriques de Jeumont.—Machine for armouring electric cables. 10th April, 1959. (860172.)

12579. Erie Resistor, Ltd.—Sealing of electrical components. 14th April, 1959. (859652.)

12743. Standard Telephones & Cables, Ltd. (Standard Elektrik A.G.).—Electrical sockets. 15th April, 1959. (860331.)

14046. Loblite, Ltd.—Electrical connectors. 24th April, 1959. (859822.)

14270. English Electric Valve Co., Ltd.—Frequency converting electron discharge tubes. 25th September, 1959. (860058.)

14294. Philips Electrical Industries, Ltd.—Direct voltage convertors. 27th April, 1959. (859655.)

14793. I-T-E Circuit Breaker Co.—Magnetic blowout structures for electric circuit-breakers. 30th April, 1959. (859802.)

15882. Standard Telephones & Cables, Ltd.—Ring shaped vessel for drying and impregnating electrical cables. 8th May, 1959. (859904.)

15912. Bendix Corporation.—Sealing means for electrical apparatus. 8th May, 1959. (860553.)

17384. Du Pont de Nemours & Co., E. I.—Electric blasting initiators. 21st May, 1959. (860772.)

23524. Svenska Relafabriken A.B.—Devices for limiting the power losses in d.c. control devices. 8th July, 1959. (860061.)

24227. Metallgesellschaft A.G.—Collecting electrodes for electrostatic precipitators. 14th July, 1959. (859870.)

25519. Siemens-Schuckertwerke A.G.—Current corrector installations. 24th July, 1959. (860452.)

27219. Proctor Electric Co.—Cooking temperature control apparatus. 10th August, 1959. (860339.)

27598. Syncro Corporation.—Electric generators. 12th August, 1959. (860176.)

31059. Brookhirst Igranic, Ltd.—Means for preselecting the time interval between the starting and stopping of one or a plurality of functions. 11th September, 1959. (860222.)

34176. Radiation, Ltd.—Electric hotplate appliances. 8th October, 1959. (860742.)

34745. Celleco A.B.—Method and means for the transfer of heat in refrigerating systems. 14th October, 1959. (860105.)

35428. Bosch G.m.b.H., R.—Electric motors. 20th October, 1959. (860802.)

38946. Philips Electrical Industries, Ltd.—Reflex klystrons. 17th November, 1959. (860114.)

39801. Electrolux Corporation.—Electric floor polishers. 24th November, 1959. (860627.)

42949/50. Micklethwait, E. W. E. (Garrett Corporation).—Automatic electric control apparatus. 10th May, 1957. (Divided out of 860227.) (860228/9.)

1960

12148. Lindly & Co., Inc.—Photoelectric system. 17th June, 1957. (Divided out of 860270.) (860271.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 18th February:—

Hyperlap. No. B802,625. Class 7. Machines for applying insulating tapes to electrical conductors.—Insulating Sleevings & Tapes, Ltd., Electron Works, Brook Street, Preston, Lancs.

Contimet. No. 795,291. Class 7. Machine tools, motors and engines (not for vehicles), generators, dynamos and turbines, etc.—Continental Titanium Metals Corporation S.A., Luxembourg. Address for service: Hyde & Hyde, 4, Broad Street Buildings, Liverpool Street, London, E.C.2.

Erma. No. 797,581. Class 8. Crimping tools for use in connecting electrical terminals to wire and cable, hand tools for stripping and cutting wire and cable, etc. Also No. 797,582. Class 9. Terminal ends, cable lugs and bonding leads for electrical connections.—Erma, Ltd., Mount Pleasant, Alperton, Wembley, Middlesex.

Aerialite. No. 778,545. Class 9. Scientific and electrical apparatus and instruments, batteries, cables, lightning arrestors, electrical connection boxes, wiring leads for radio, television, telephone, etc.—**Aerialite, Ltd.,** Castle Works, Stalybridge, Ches.

Intermarine. No. 800,426. Class 9. Electrical and electronic apparatus and instruments, and electrical apparatus for use in the control of voltage, current, speed and position of electrical machinery.—N.V. Electrotechnische Industrie Voorheen Willem Smit & Co., Rotterdam. Address for service: Reddie & Grose, 6, Bream's Buildings, London, E.C.4.

Elga. No. B805,773. Class 9. Scientific and electrical apparatus and instruments (not including electric welding apparatus).—Elga Products, Ltd., Lane End, Bucks.

Xactrol. No. 806,096. Class 9. Instruments for measuring, indicating, recording and automatically controlling temperatures, conductivity, hydrogen ion concentration, electric current, voltage, optical density, smoke, atmospheric suspensions, and pressure; safety devices for automatically controlling and indicating failure in gas and electrical equipment; and electric control valves.—Ether, Ltd., Tyburn Road, Erdington, Birmingham, 24.

Magnacam. No. 807,094. Class 9. Electrical apparatus having cam-operated contacts for controlling electrical circuits on a time basis.—D. Robinson & Co., Ltd., Gunnersbury House, 717, London Road, Hounslow, Middlesex.

Stanox. No. 809,743. Class 9. Electric resistances.—Radio Resistor Co., Ltd., 9-11, Palmerston Road, Wealdstone, Harrow, Midx.

Termilode. No. 809,755. Class 9. Electrical and electronic instruments and apparatus.—Morganite Resistors, Ltd., Paulsway, Bede Training Estate, Jarrow, Co. Durham.

Safelec. No. 810,364. Class 9. Track electrification systems for conveyors, runways and cranes.—Geo. W. King, Ltd., Argyle Works, Stevenage, Herts.

Darstan. No. 810,731. Class 9. Electrical and radio apparatus and instruments.—Walter Standing, 26, Rayleigh Road, Thundersley, Essex.

MEM

'GLASGOW-EXEL'

HEAVY DUTY

Composite Units of Switches & Fuses

Complying with B.S.3185: 1959

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440 Volts A.C.
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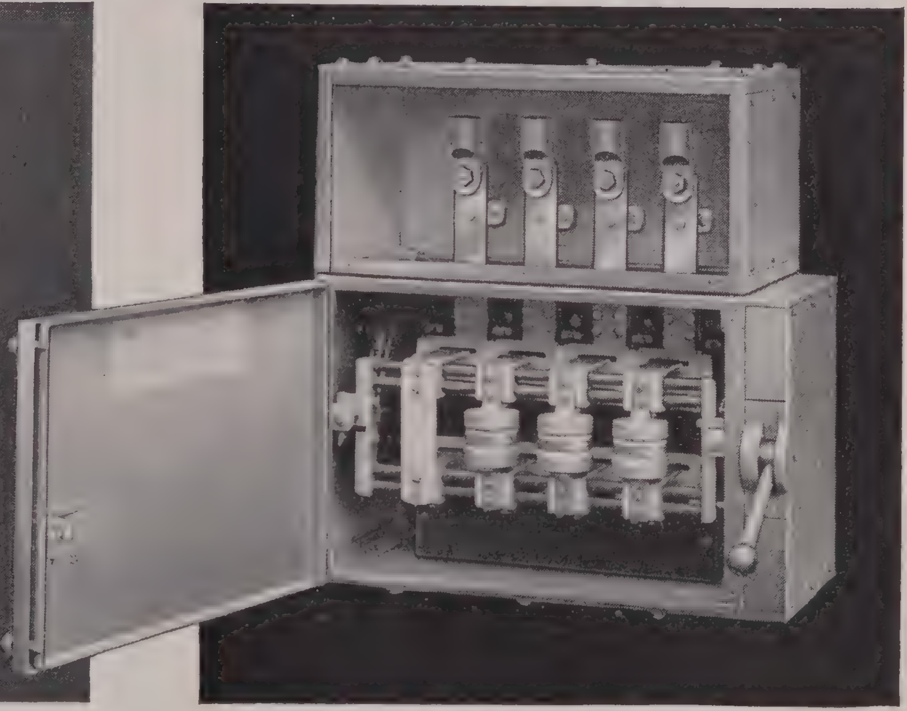

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The 800 amp "Glasgow-Exel" dealt effectively with an applied test current of 2,400 amps at 485 volts with a power factor of 0.25 lagging.

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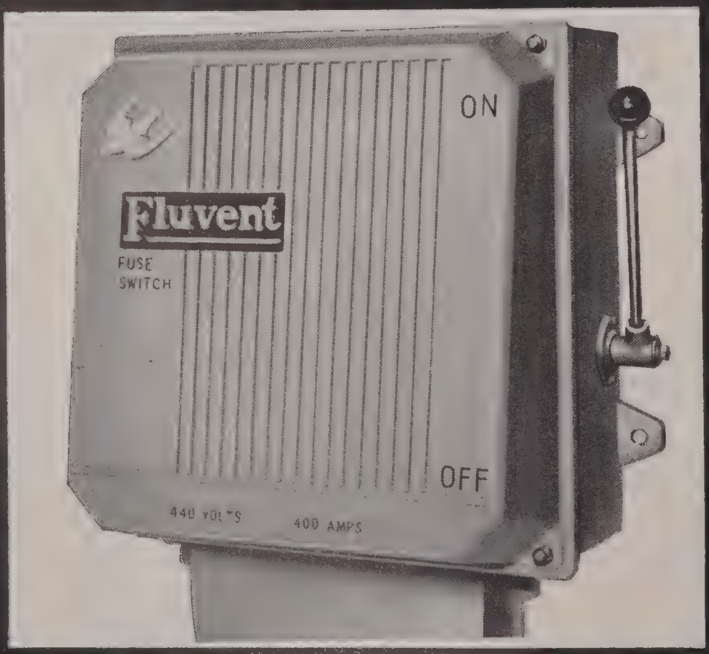

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 30th JANUARY

Arborfield.—Unit Cinema, Training Bn., R.E.M.E., 7 p.m. I.E.E. London Graduate and Student Section. "Automatic Trunk Dialling," by H. E. Francis.

Birmingham.—Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. "Visual Perception," by R. G. Hopkinson.

Edinburgh.—Canteen, South of Scotland Electricity Board, Dewar Place, 7.30 p.m. I.E.E. South East Scotland Sub-Centre. Graduate and Student Section. "The Application of Electronics to Chemical and Gas Analysis," by G. J. Geis.

Ipswich.—Electric House, 6.30 p.m. I.E.E. East Anglian Sub-Centre. "A Survey of Street Lighting and its Future," by W. R. Stevens and H. M. Ferguson.

Leeds.—Houldsworth School of Applied Science, Leeds University, 7.30 p.m. Institution of Plant Engineers, West and East Yorkshire Branch. "The Uses of Molybdenum Disulphide," by G. J. Vineall.

London.—John Adam Street, Adelphi, W.C.2, 6 p.m. Royal Society of Arts. Cantor Lecture. "The Chemical and Plastics Industries," by J. Taylor.

Newcastle-upon-Tyne. — Rutherford College of Technology, Northumberland Road, 6.15 p.m. I.E.E. North-Eastern Measurement and Electronics Group. "Radar Observations of Birds and 'Angels'," by E. Eastwood.

Watford.—Compass Hotel, 7.45 p.m. A.S.E.E. North West London Branch. "Static Switching Control Systems," by J. N. Fletcher.

TUESDAY, 31st JANUARY

London.—Manson House, 26, Portland Place, W.1, 7 p.m. Society of Instrument Technology, Data Processing Section. "Instrumentation Past, Present and Future," by L. S. Yoxall.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Supply Group. "A Basis for Short Circuit Ratings for Paper Insulated Cables up to 11 kV," by L. Gosland and R. G. Parr, and "Short Circuit Ratings for Mains Cables," by G. S. Buckingham.

Workington.—College of Further Education, 7 p.m. I.E.E. North-Eastern Centre. "The Determination of the Electrical Characteristics of an Arc Furnace," by J. Ravenscroft.

WEDNESDAY, 1st FEBRUARY

Edinburgh.—Y.M.C.A. Social Room, 14, South St. Andrew Street, 6.15 p.m. I.E.S. Edinburgh Centre. "Lighting in Industry in the Soviet Union," by E. H. Norgrove.

Halifax.—Crown Hotel, Horton Street, 7.45 p.m. A.S.E.E. Halifax Branch. "Instrumentation," by D. M. Everett.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. London Supply Section. "The Protection of High-Voltage Insulators from Power-Arc Damage," by A. E. Guile.

Eltham Green School, Queenscroft Road, Eltham, S.E.9, 7.45 p.m. A.S.E.E. South East London Branch. "Relays and Control Circuits," by Dr. W. L. Stern.

Town Hall, Wood Green, N.22, 8 p.m. A.S.E.E. North London Branch. "The Application of Electric Furnaces to the Heat Treatment of Metals," by L. G. Palethorpe.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 5.30 p.m. British Institution of Radio Engineers, Radar Group. "A Fast Electronically Scanned Receiving System," by D. E. N. Davies.

Middlesbrough.—Cleveland Scientific and Technical Institution, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. North-Eastern Centre chairman's address, by D. H. Thomas.

Newcastle-upon-Tyne.—Room B7, Percy Building, King's College, Queen Victoria Road, 6.15 p.m. I.E.S. Newcastle-upon-Tyne Centre. "Hospital Lighting," by G. R. N. Chalmers.

Portsmouth.—C.E.G.B. Offices, 6.30 p.m. I.E.E. Southern Centre. "The Potentialities of Artificial Earth Satellites for Radiocommunication," by W. J. Bray. (Joint meeting with the Graduate and Student Section.)

Preston.—R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. "The Architect and the Engineer in Building Construction," by R. Booth.

Rugby. — College of Engineering Technology, 6.30 p.m. I.E.E. Rugby Sub-Centre. "A Universal Non-Linear Filter," by Prof. D. Gabor.

THURSDAY, 2nd FEBRUARY

Bristol.—Cabot House, College of Technology, Ashley Down, 7 p.m. I.E.E. Bristol Graduate and Student Section. "Some Applications of Magnetic Recording," by H. M. Harrison.

Carlisle.—Technical College, 7 p.m. I.E.E. North-Eastern Centre. Lecture "Street Lighting" and paper "A Survey of Street Lighting and its Future," by W. R. Stevens and H. M. Ferguson.

Chelmsford.—Hoffmann's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "Automatic Control of Steel Rolling Mills," by W. N. Jenkins.

Edinburgh.—Charlotte Rooms, 8 p.m. I.E.E. South East Scotland Sub-Centre. Annual dance (in conjunction with the Institutions of Civil and Structural Engineers).

Glasgow.—Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, C.2, 6 p.m. I.E.E. South West Scotland Sub-Centre. "Engineering and Civilisation," by Sir Hugh Beaver. (Joint meeting with I.C.E. and I.Mech.E.)

British Lighting Council, 29, St. Vincent Place, 6.30 p.m. I.E.S. Glasgow Centre. "Office Lighting," by L. H. Hubble.

Hove.—New Imperial Hotel, 1st Avenue, 7.30 p.m. A.S.E.E. Brighton, Hove and District Branch. "Motor Control Centres," by N. E. Steptoe.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. London Utilisation Section. "Silicon Power Rectifiers," by A. J. Blundell, A. E. Garside, R. G. Hibberd and I. Williams.

Manchester.—Reynolds Hall, College of Technology, 7 p.m. British Institution of Radio Engineers, North Western Section. "The Manufacture of Television Tubes," by P. Funnell.

FRIDAY, 3rd FEBRUARY

Belfast. — Civil Engineering Department, David Keir Building, Queen's University, Stranmillis Road, 6.30 p.m. I.E.E. Northern Ireland Centre. Annual dinner-dance.

Birmingham.—Grosvenor Room, Grand Hotel, 6.30 p.m. I.E.E. South Midland Centre. Annual dinner.

Crewe.—Royal Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. "Electrical Catering Equipment," by H. Meadowcroft.

Dundee.—Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Engineering and Civilisation," by Sir Hugh Beaver. (Joint meeting with I.C.E. and I.Mech.E.)

Fawley.—Esso Refinery, 5.30 p.m. Society of Instrument Technology, Fawley Section. "Instrumentation in Radio Astronomy," by Dr. H. P. Palmer.

Ipswich.—Great White Horse Hotel. Ipswich and District Electrical Association. Annual dinner.

Liverpool.—Industrial Development Centre, M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "Static Switching Control Systems," by J. N. Fletcher.

London. — Savoy Place, W.C.2, 6 p.m. I.E.E. Medical Electronics Discussion Group. Discussion, "Recent Technical Developments in Eye Movement Recording," to be opened by P. A. Merton and Dr. C. Rashbass.

Gatwick Airport. A.S.E.E. South London Branch. Annual dinner-dance.

Pepys House, 14, Rochester Row, Westminster, S.W.1, 7 p.m. Junior Institution of Engineers. Films including "Power Line to Kitimat."

Sale.—Embassy Rooms (Locarno), Washway Road, 6.45 for 7.15 p.m. I.E.E. North Western Utilisation Group. Annual dinner-dance.

Swansea.—I.E.S. Swansea Group. Annual dinner and dance.

SATURDAY, 4th FEBRUARY

Manchester.—Engineers' Club, Albert Square, 7.15 p.m. A.S.E.E. Manchester Branch. "Heavy Industrial Control Gear," by C. V. Curran.

STREET LIGHTING NOTES

The A.E.I. Lamp & Lighting Co., Ltd., has received an order for lighting approximately three miles of the Edgware Road using the new Mazda linear (straight tube) sodium lamps. The order, which includes Stewarts & Lloyds 30ft steel columns and the new "Amberline" side entry lanterns, is worth approximately £6,000.

Haltwhistle R.D.C. is considering a street lighting improvement scheme costing nearly £6,000, and the North Eastern Electricity Board have been asked to prepare detailed plans. The work will include replacing 122 lamps with colour-corrected mercury vapour lamps and installing sodium lighting on the trunk road.

Electric street lighting in **Crewe** is to be brighter. Several main roads have already had improved lighting installed, and now a further £50,000 is recommended to be spent, spread over five years.

For lighting the proposed **Wolverhampton** ring road, the first part of which is now under construction, Philips SOI/H integral type 200 W sodium lamps are to be used in Revo Electric lanterns on 35ft steel columns with a 4ft outreach supplied by Stewarts & Lloyds, Ltd. The lanterns will be spaced 140ft apart and placed opposite each other on the outside of the dual 24ft carriageways.

Salford Highways and Street Lighting Committee is to seek sanction to borrow £20,000 for the conversion of side street lighting.

Bedford Highways and Sewerage Committee recommends the installation of Group "A" street lighting in Park Avenue, at an estimated cost of £6,000.

Chelmsford Roads Committee has approved revised proposals submitted by the borough engineer for the improvement of the street lighting in Duke Street and Tindal Square, at an estimated cost of £3,045.

Hornsey Corporation is recommended to invite tenders for the installation of new street lighting in Archway Road and Great North Road.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where " Contracts Open " are advertised in our " Official Notices " section the date of the issue is given in parentheses

Belfast.—Electricity Department. 17th February. Materials for twelve months commencing 1st May next. (See this issue.)

Ceylon.—Ministry of Industries, Home and Cultural Affairs, Colombo. 22nd February. Electronic equipment. (E.S.B. 613/61/I.C.A.)*

Duffield.—Parish Council. 6th February. Trunk road lighting. (See this issue.)

Durham.—County Council. 8th February. Electrical installation in Wingate New Secondary Modern School. (See this issue.)

Electrical installations in the Felling Leam Lane Youth Centre and Leasingthorne Junior and Infants' School. County architect, South Street, Durham.

Ealing.—Borough Council. 23rd February. Renewal of electrical installations in Drayton Infants' and Perivale Primary Schools. (See this issue.)

Ghana.—Supply Commission. 23rd February. Diesel engine-driven generating set. (E.S.B. 820/61.)*

Hertfordshire.—County Council. Applications are invited from firms for inclusion in the Council's list of contractors for building, maintenance, heating and electrical work. (See this issue.)

Hornsey.—Borough Council. 13th February. Annual contract for the supply of sodium discharge lamps. (See 20th January issue.)

India.—Rajasthan State Electricity Board, Jaipur. 9th February. Electrical equipment and machine tools. (E.S.B. 566/61.)* 15th February. Testing equipment for meters and relays. (E.S.B. 559/61.)* 27th February. Automatic reclosures. (E.S.B. 535/61.)*

Punjab State Electricity Board, Patiala. 14th February. Transmission line equipment. (E.S.B. 687/61.)* 6th-8th March. Two 132/33/11 kV and two 66/11 kV power transformers. (E.S.B. 620/61.)*

Rihand Electricity Department, Kanpur. 22nd February. Electrical connectors. (E.S.B. 558/61.)*

Director General of Supplies and Disposals, New Delhi. 16th February. Overhead travelling cranes. (E.S.B. 560/61.)* 22nd February. Overhead electric cranes. (E.S.B. 688/61.)*

Mysore State Electricity Board, Bangalore. 20th February. 110/33/13·2 kV transformers. (E.S.B. 690/61.)*

King's Lynn.—Borough Council. 16th February. Electrically driven pumping equipment. Borough engineer, 17, Queen Street.

New Zealand. — Dunedin Electricity Department. 17th March. 33 kV series current limiting reactors. (E.S.B. 700/61.)*

Norway.—N.A.T.O. Infrastructure Contract. 16th March. Telephone exchange. Applications to tender not later than 4th February. (G.D. 159/60(20).)†

Pakistan.—Eastern Bengal Railway, Chittagong. 14th February. 20,000 dry cells. (E.S.B. 664/61.)* 16th February. D.c. relays. (E.S.B. 665/61.)* 13th March. Nineteeen electric motors. (E.S.B. 666/61.)*

Directorate General, Posts and Telegraphs. 16th February. H.f. communication receivers. (E.S.B. 512/61.)*

Poole.—Borough Council. 15th February. Electric wiring supplies and accessories (Form No. 23); electric lamps (24); batteries (25); street lighting lanterns (26); time switches (26a); and electric water heaters (28), for the year ending 31st March, 1962. Borough engineer, Municipal Buildings.

Salford.—Corporation. 21st February. Street lighting equipment. (See this issue.)

South Africa.—Union Tender Board, Pretoria. 9th February. Accumulators. (E.S.B. 553/61.)*

Tynemouth.—Borough Council. 13th February. Supply of electric lamps and cable; lamp columns, lanterns and fittings; and housing electrical accessories, for the year ending 31st March, 1962. Borough surveyor, 16, Northumberland Square, North Shields.

Widnes. — Corporation. 16th February. Electrical materials for twelve months ending 31st March, 1962. (See this issue.)

ORDERS PLACED

Barking.—Borough Council. Lifts in connection with Linton Road/Church Road redevelopment scheme (£43,782) and Mayesbrook Meadow (£7,404).—Otis Elevator Co.

Harrow.—Corporation. Recommended. Improved lighting in Edgware Road from Greenway Gardens to London Road (£5,989).—A.E.I. Lamp & Lighting Co.

Southend-on-Sea.—Corporation. Electrical installation work at Fairfax High School for Boys (£2,384).—Brookes Electrical Services.

Swinton and Pendlebury.—Corporation. Recommended. Electrical installations in 76 dwellings, Clifton estate (£2,422).—William Lee.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aylesbury.—Houses and flats (104), Oakfield estate; borough engineer, Town Hall.

Barking.—Extensions to Eastbury Secondary School (£28,000) and alterations to South East Essex County Technical School (£10,000); borough architect, Town Hall.

Bedfordshire.—Clapham/Oakley County Secondary School (£100,000); county architect, Shire Hall, Bedford.

Cambridge.—Houses (99), Arbury Road North estate; city surveyor, The Guildhall.

Cannock (Staffs.).—Houses (40); H. Wilcox, architect, High Green.

Cheshire.—Erection of secondary modern schools at Cheadle, Harlford, Hazel Grove and Wilmslow (about £150,000 each); E. Taberner, county architect, County Hall, Chester.

Eastbourne.—Offices (£60,000), Commercial Road; J. G. Robinson & Sons, Ltd., 6, Cornfield Terrace.

Essex.—Fire station, Wennington; H. Conolly, county architect, County Hall, Chelmsford.

Farnworth.—Houses (150), Plodder Lane; borough engineer.

Felling (Co. Durham).—New premises, High Street, for Martins Bank, Ltd.; H. F. Brown, architect, 16, The Grove, Gosforth, Northumberland.

Glasgow.—Factory, Cumbernauld Industrial estate; Thames Board Mills, Ltd., Purfleet.

Great Yarmouth.—Central X-ray department, Northgate Hospital; Olley & Haward, architects, 5, Queen Street.

Grimsby.—Further 50 houses and flats, Immingham (1961 programme); R.D.C. surveyor.

Hampshire.—Northern junior school, Portchester; county architect, The Castle, Winchester.

Hereford.—Works extensions; Saunders Valve Co., Ltd., Blackfriars Street.

Ilfracombe.—Bus station and offices, Ropery Road; Southern National Omnibus Co., Ltd., 48, Queen Street, Exeter.

Ilkeston.—Proposed bus station (£45,000); borough engineer, Town Hall.

Ipswich.—Home for aged persons, Chantry estate; borough engineer.

Llwchwr.—Dwellings (102), Loughar area; Reema Construction Co., Ltd., Milford Manor, Salisbury.

London.—Flats in multi-storey blocks, Plough Road, Battersea; George, Trew & Dunn, architects, 50, Eastbourne Terrace, W.2.

Out-patients', casualty and X-ray departments, Harlesden General Hospital; Couzens & Brown, consulting engineers, 9, Old Queen Street, S.W.1.

Manchester.—Extensions and alterations to Openshaw College for Further Education and Bank Meadow Handicraft Centre; city architect, P.O. Box 488, Town Hall.

Mitcham.—Four-storey offices; Morfax, Ltd., Willow Lane.

Reading.—Alfred Sutton Girls' Secondary School; B. Wheatley & Partners, structural engineers, Federal House, Down Place, London, W.6.

Redcar.—Dwellings (492), Lakes neighbourhood; Fredk. Gibberd, architect, 19, The Rows, Stone Cross, Harlow.

Sleaford.—Electrical services and changeover at Rauceby Hospital; McAuslan, Abbott & Partners, consulting engineers, 3, Smithfield Street, Liverpool, 3.

St. Albans.—Rebuilding and extension of departmental stores, 19-21, St. Peter's Street; staff architect, Marks & Spencer, Ltd., 82, Baker Street, London, W.1.

Stanmore.—Works extensions; Reiss Engineering Co., Ltd., Dalston Gardens.

Swansea.—Assembly hall, dining room and common room block, Swansea Training College; borough architect, Guildhall.

Taunton.—Extensions to County Offices; Goodwin & Tatum, architects, 6, Bedford Row, London, W.C.1.

Walthamstow.—Extensions (£110,000), St. George's R.C. School; D. M. Blouett, architect, 3, Ashley Place, London, S.W.1.

Weston-super-Mare. — Dwellings (132), Bournville estate; borough architect.

Willesden.—Houses (142), South Kilburn; borough engineer, Town Hall, Dyne Road, Kilburn, N.W.6.

Windermere.—Comprehensive school at Calgarth (£200,000); county architect, County Hall, Kendal.

Windsor.—Casualty and out-patients' block at King Edward VII Hospital (£100,000); regional architect, North West Metropolitan Regional Hospital Board, 40, Eastbourne Terrace, London, W.2.

Wolverhampton.—Luxury flats on six-acre site; Dolphin Development Co., Ltd., Duncan House, Dolphin Square, S.W.1.

Yorkshire.—Reconstruction of Skipton divisional police headquarters; county architect, Bishopgarth, Westfield Road, Wakefield.

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* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given. †Telephone: Trafalgar 8855, Ext. 2010.

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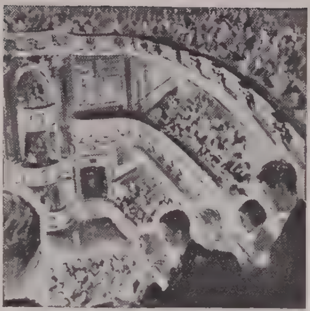

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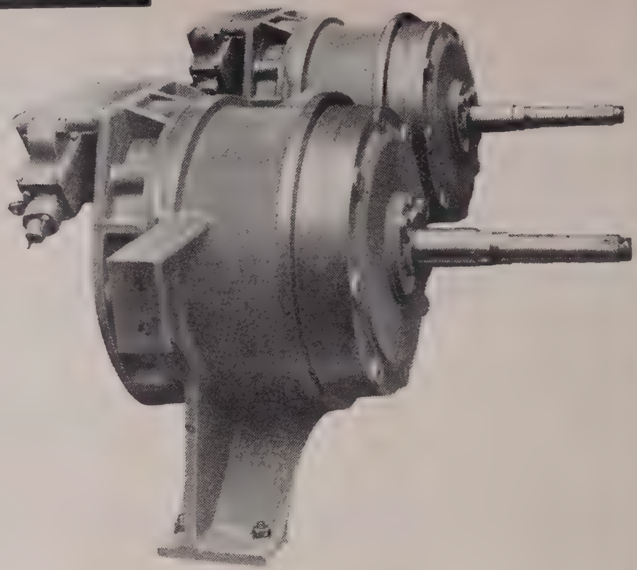

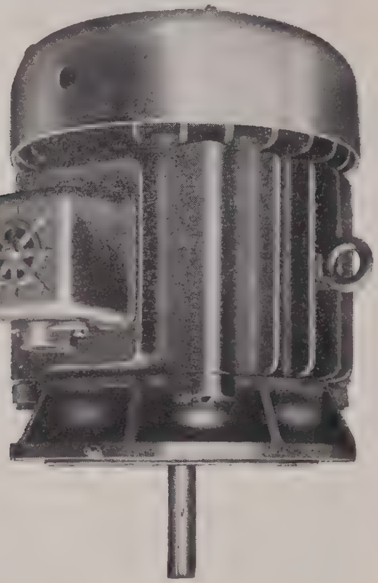

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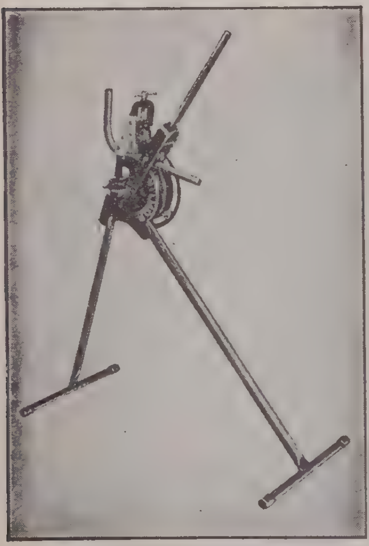

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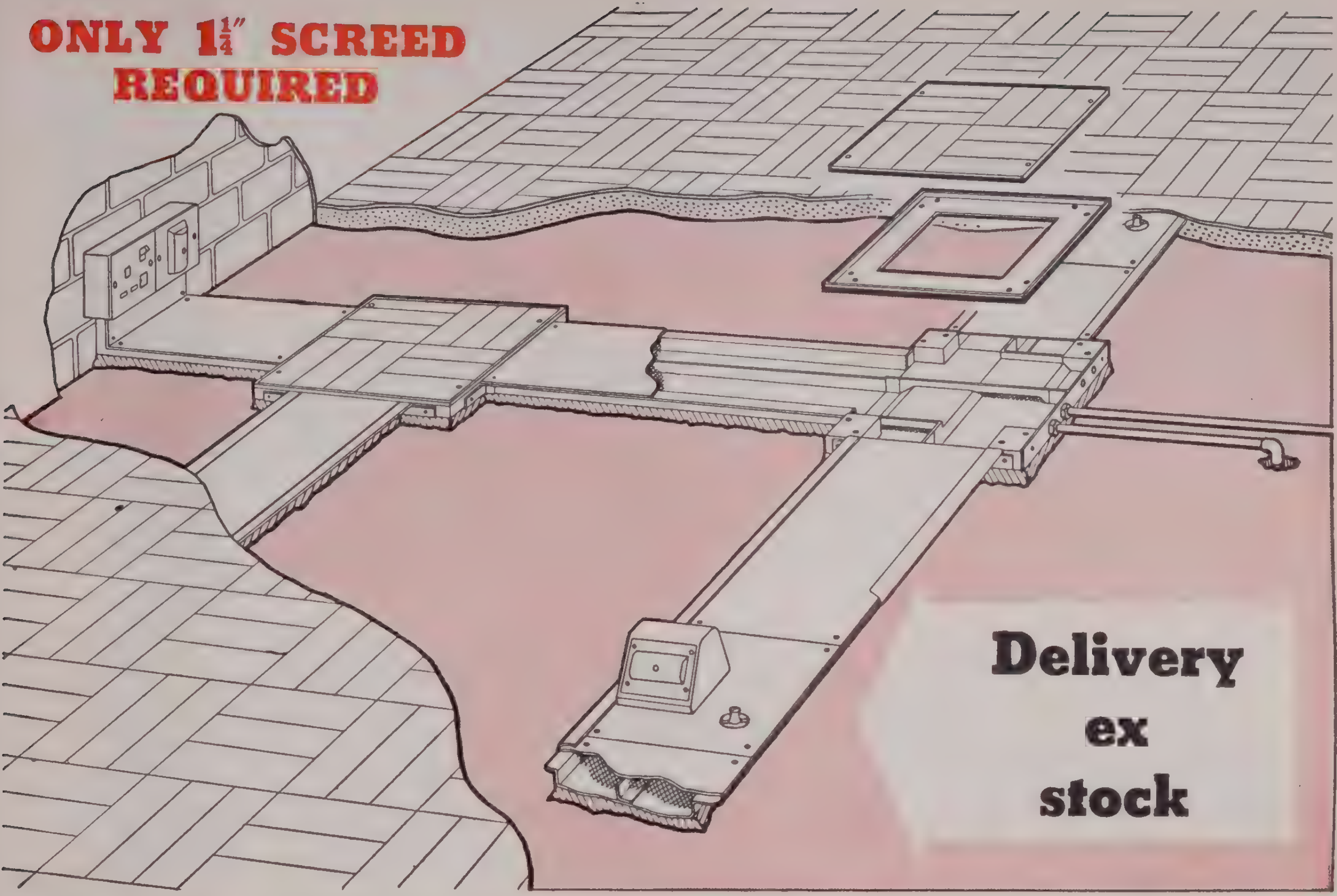

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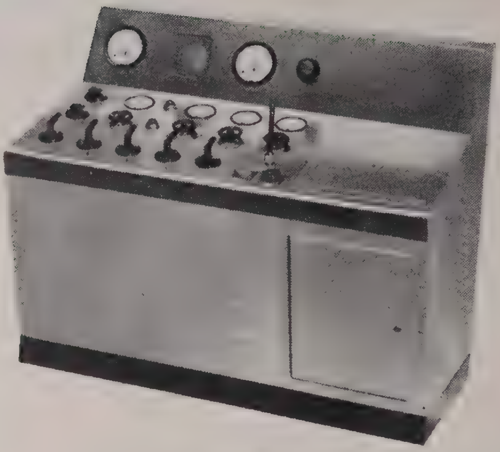

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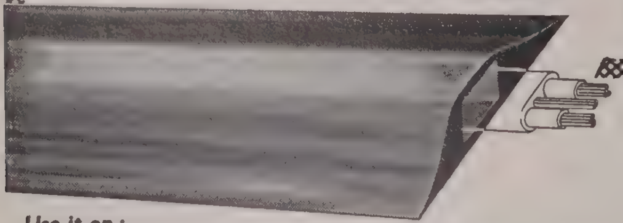

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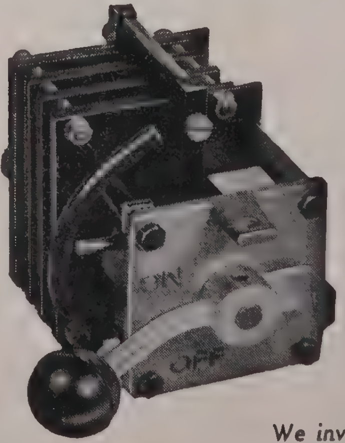

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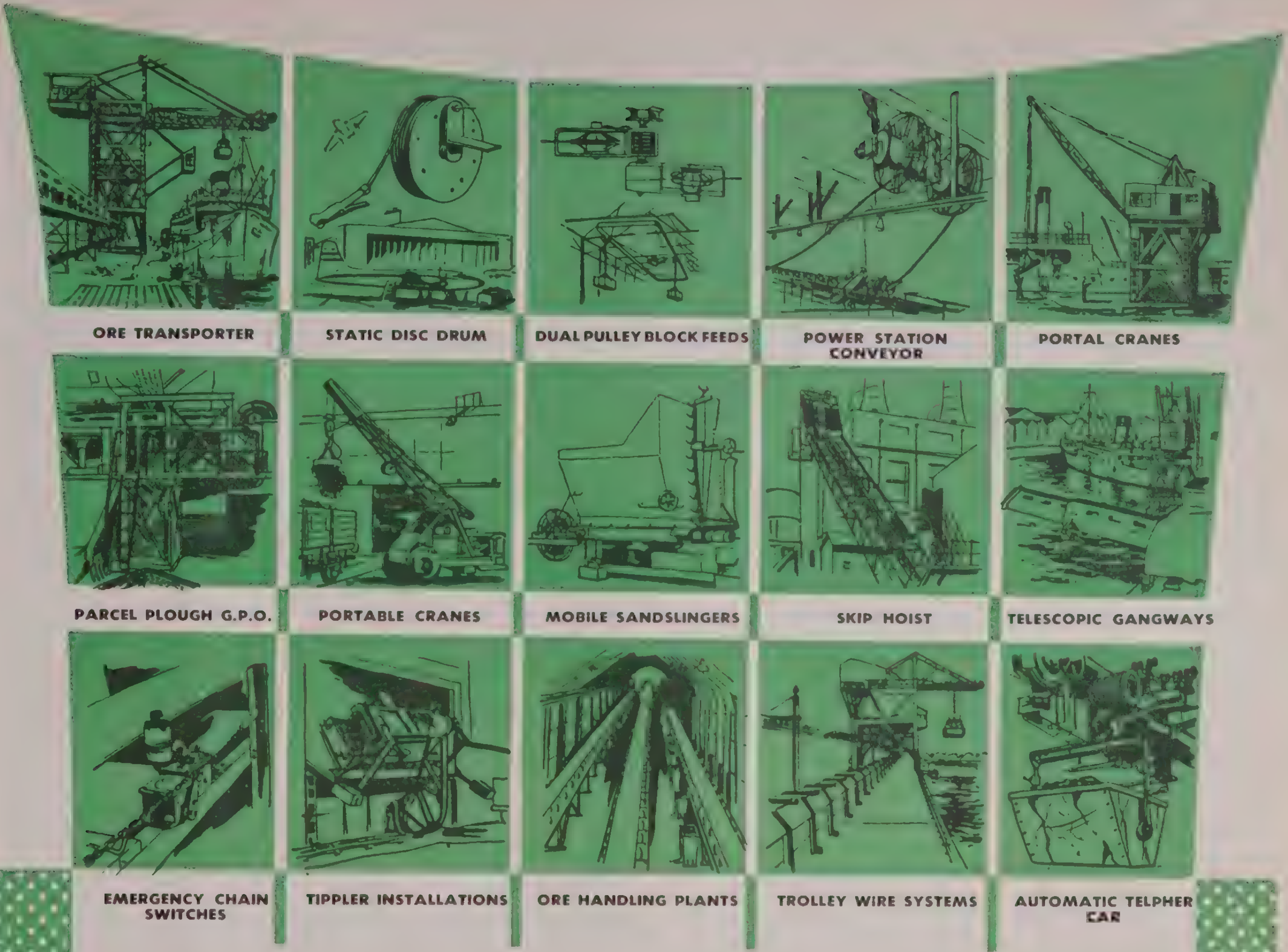

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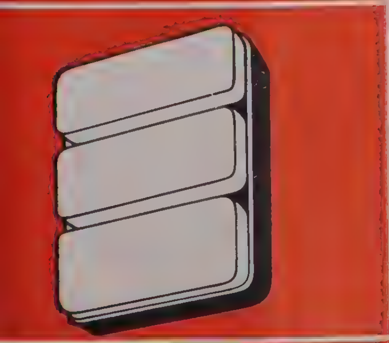

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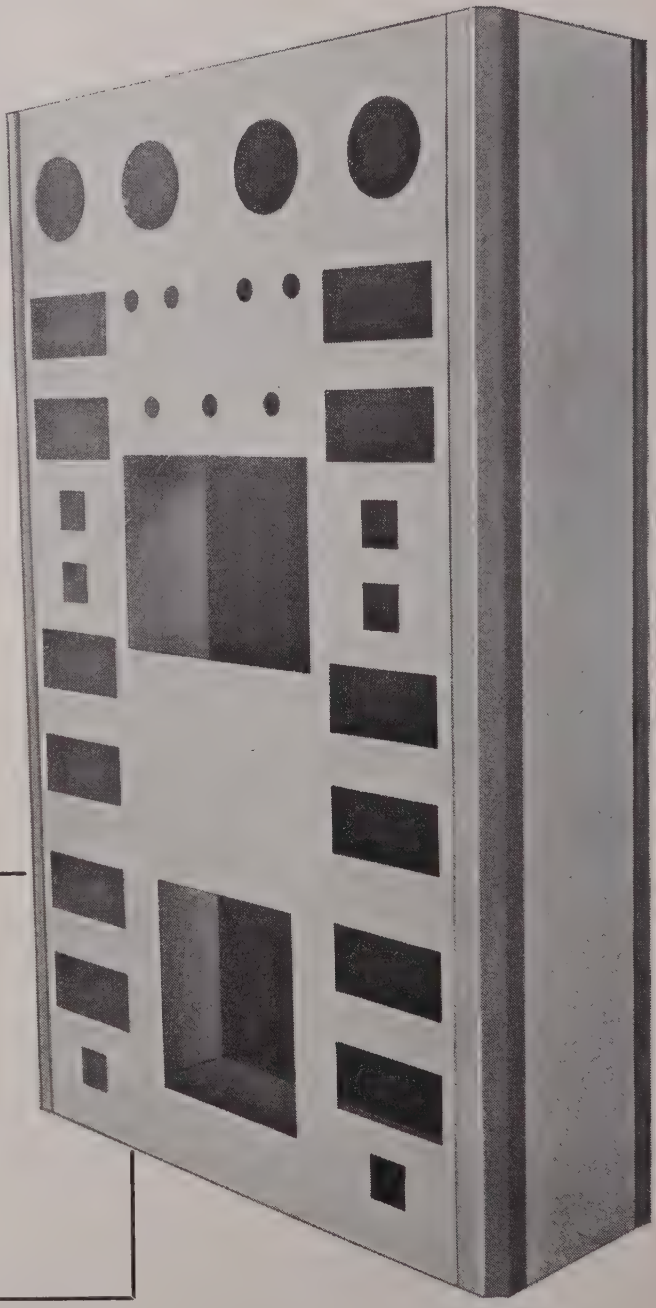

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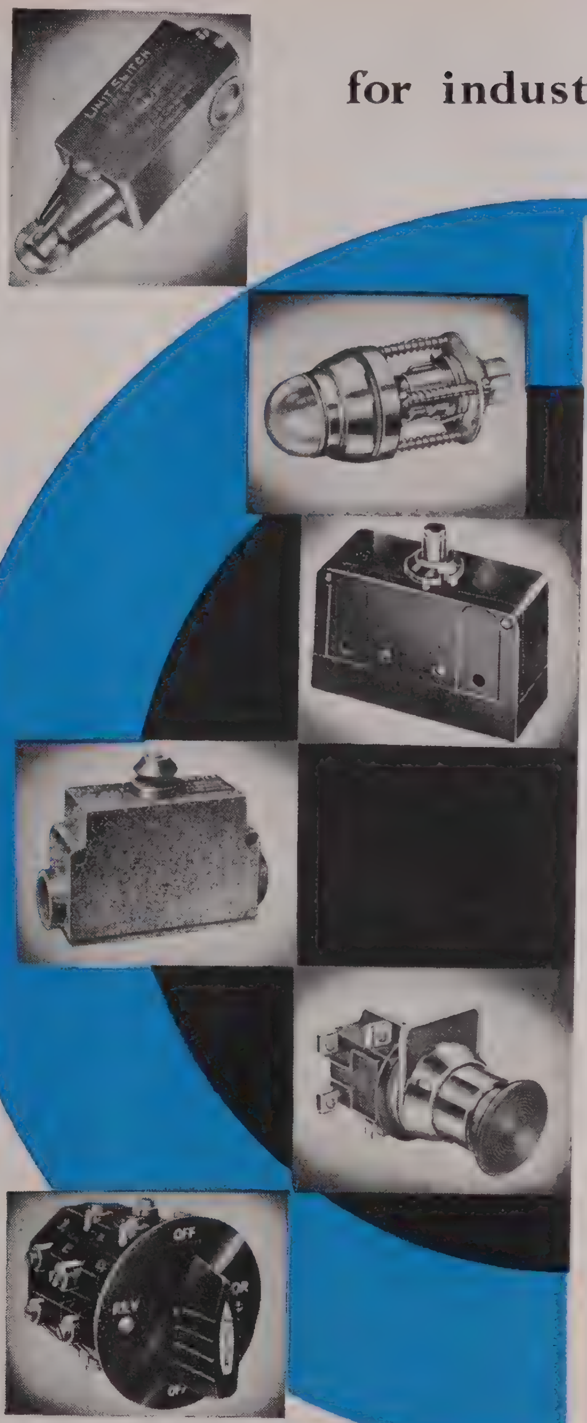

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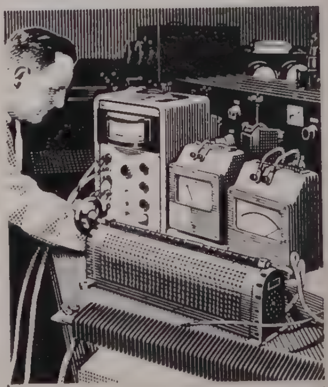

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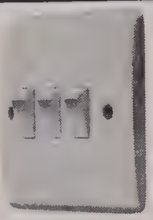

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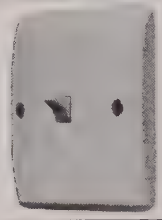

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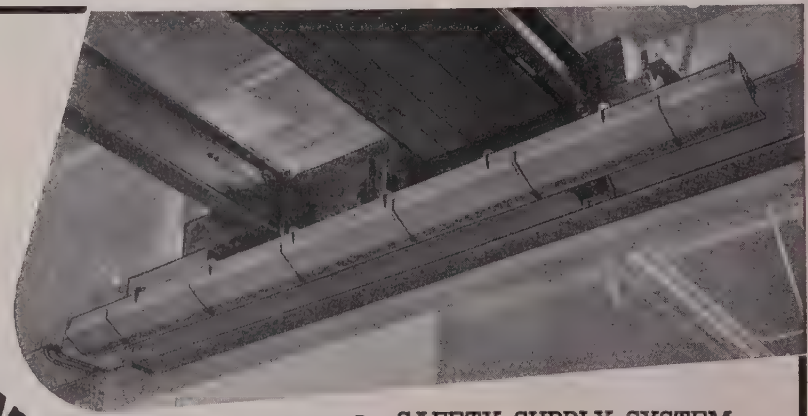

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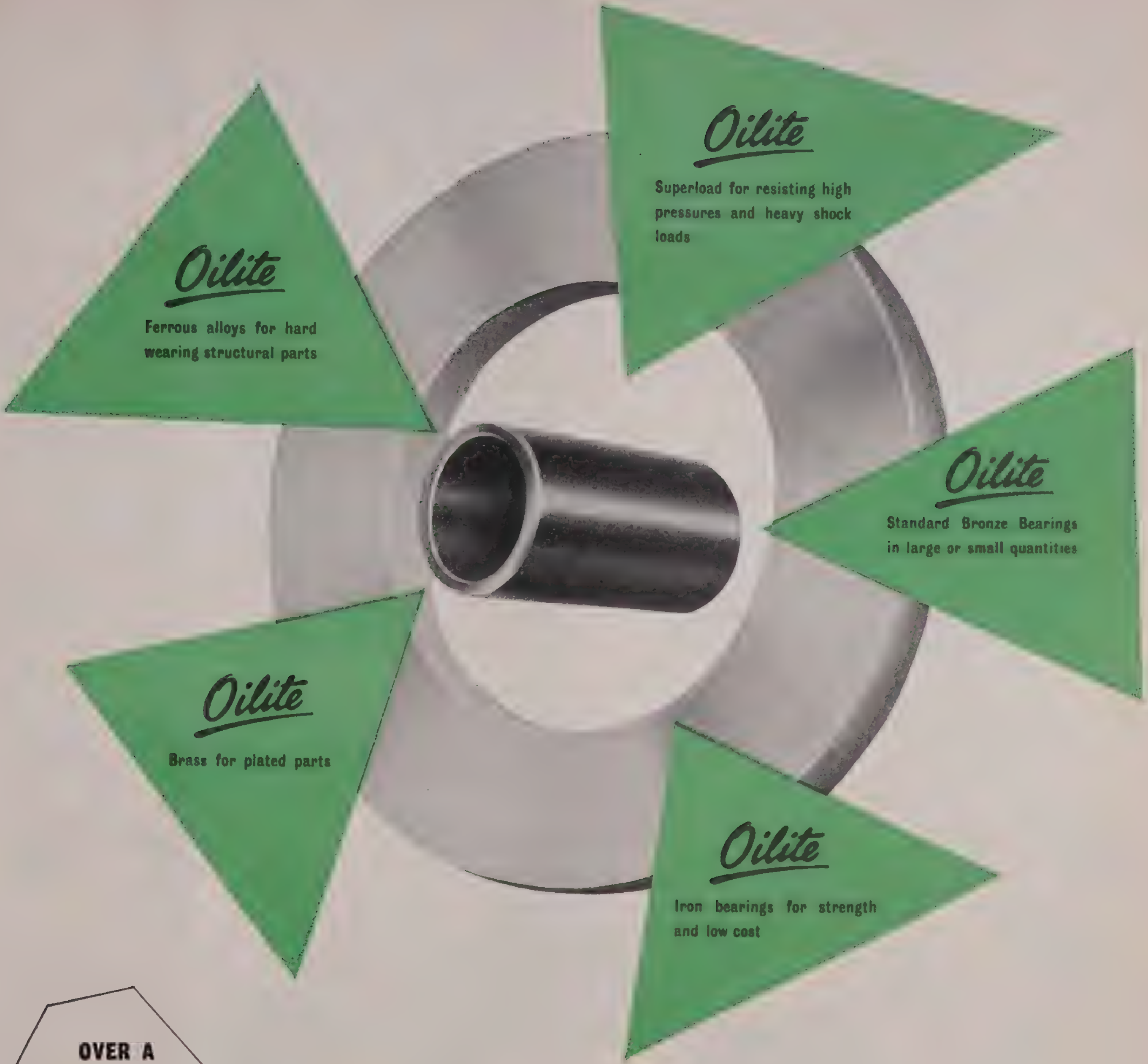
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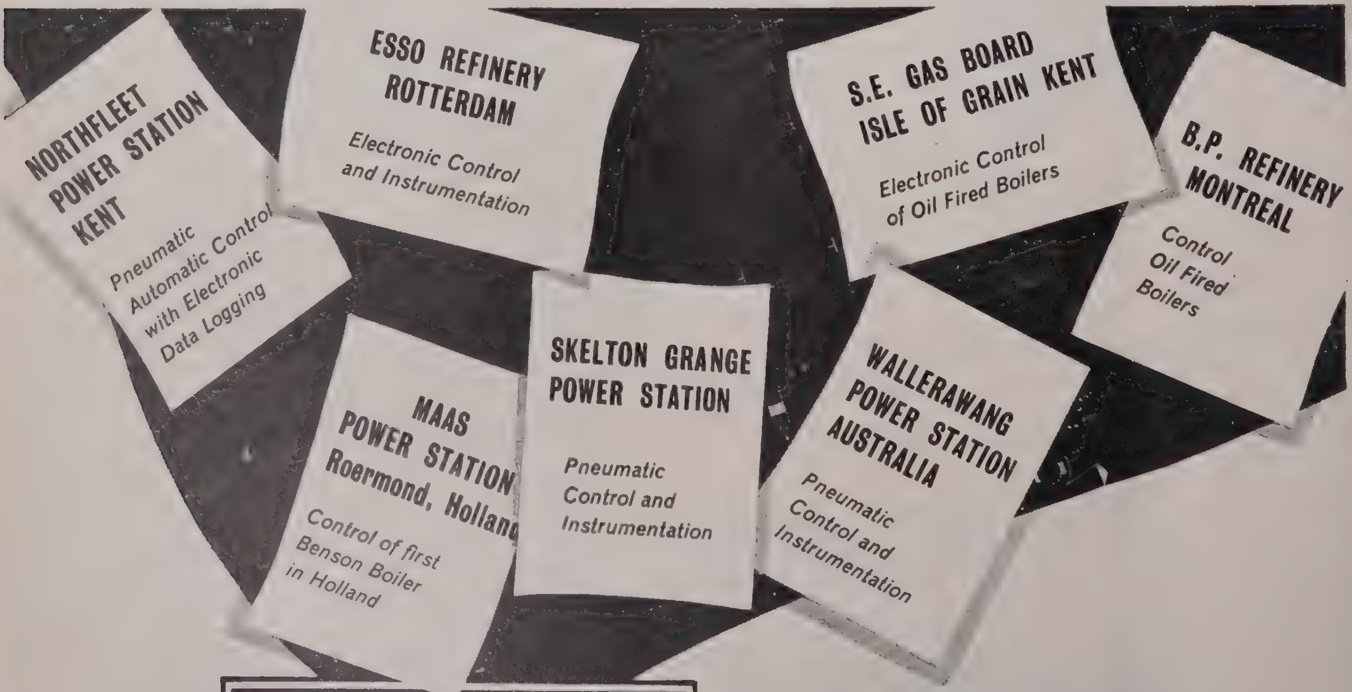

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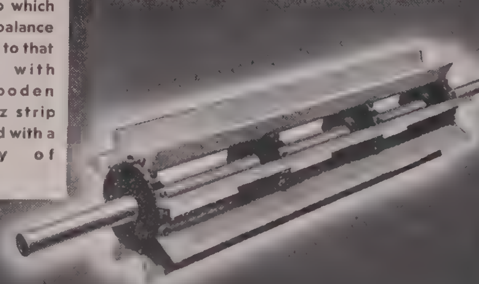

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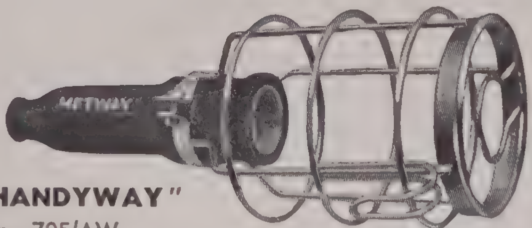

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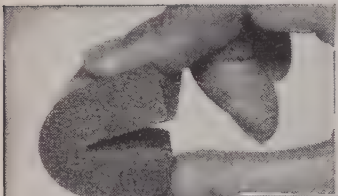

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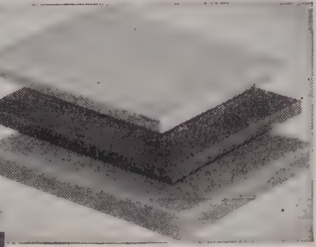

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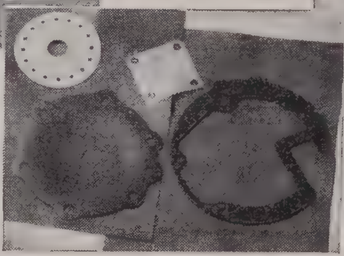

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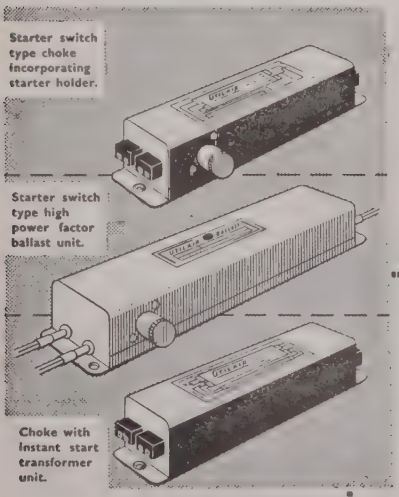
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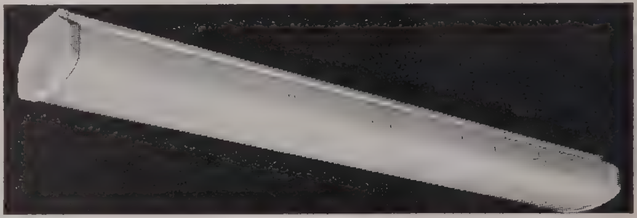

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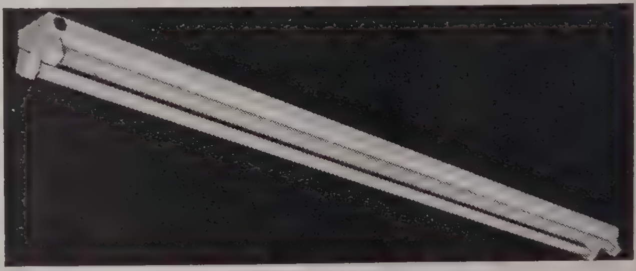

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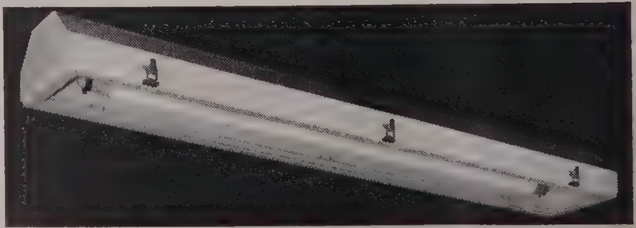

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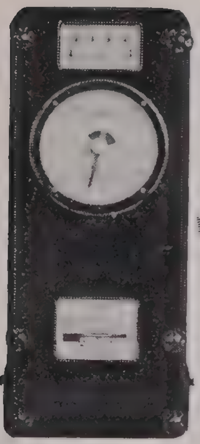

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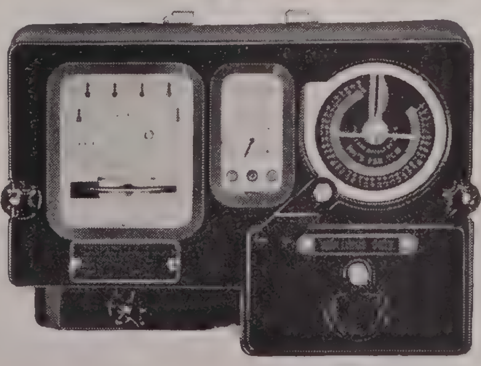

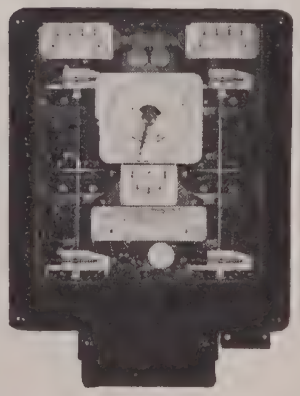

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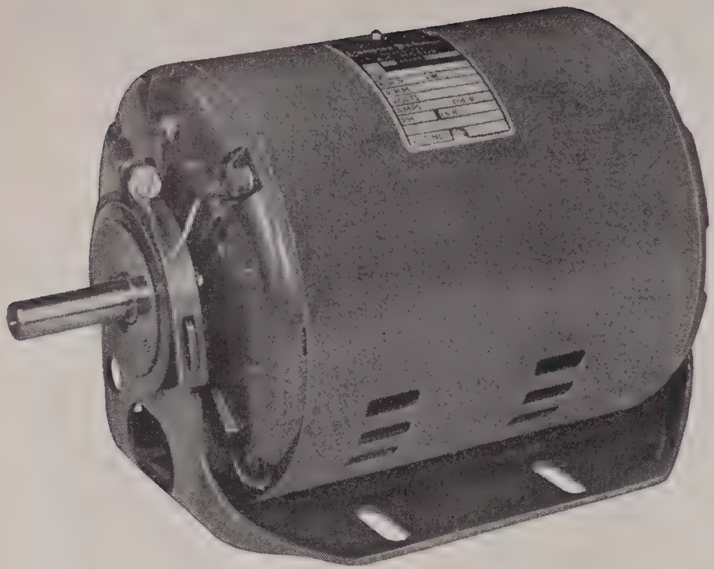

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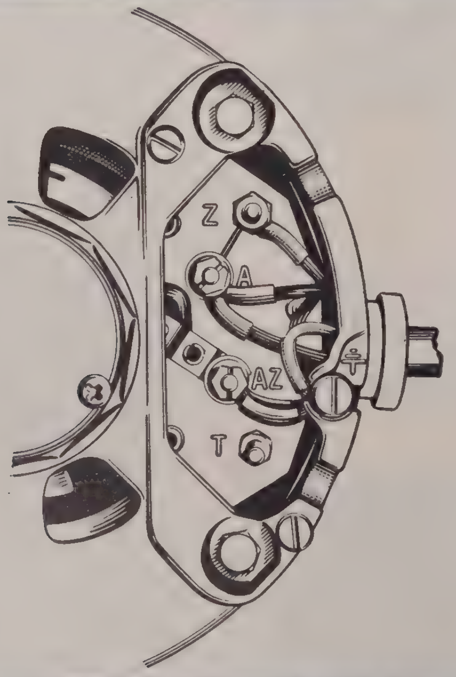

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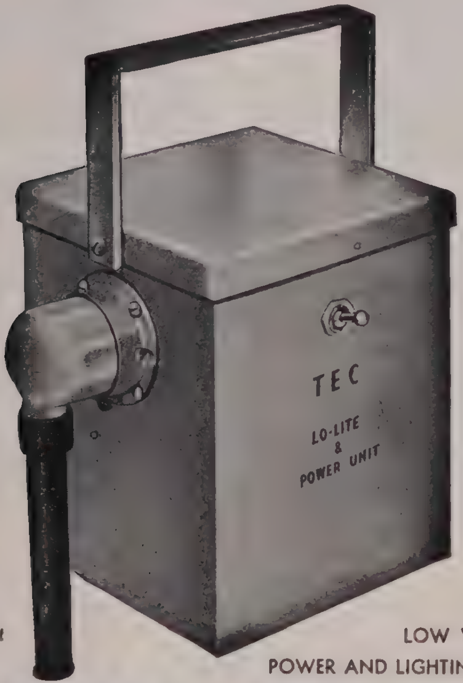

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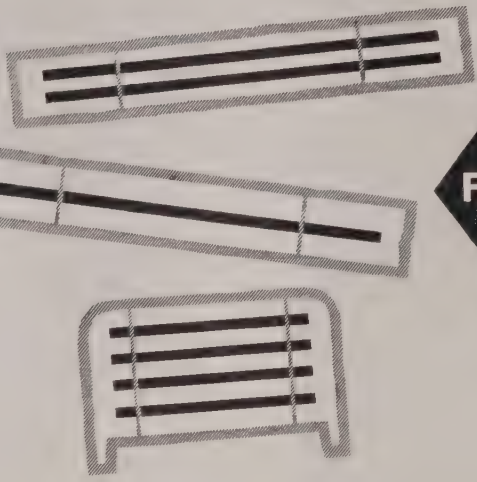

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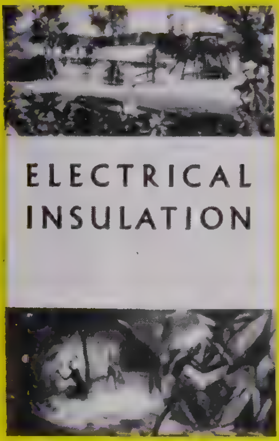

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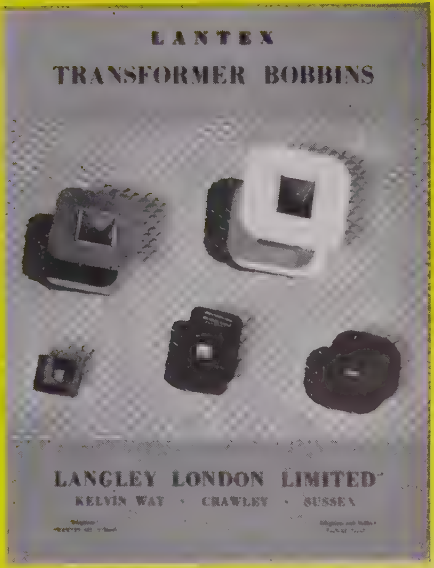

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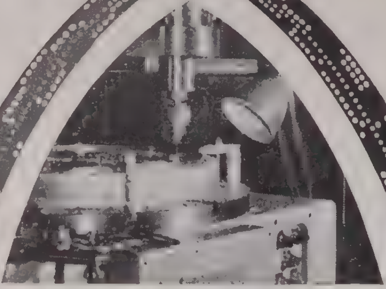

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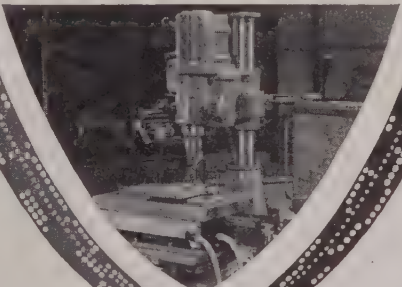

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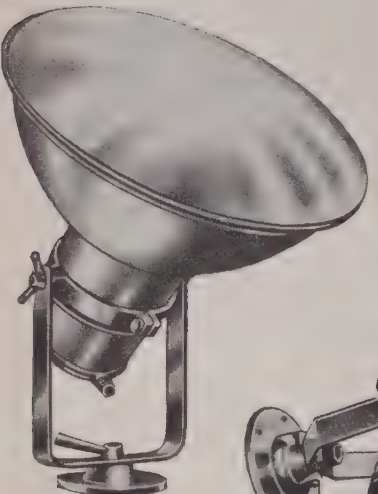

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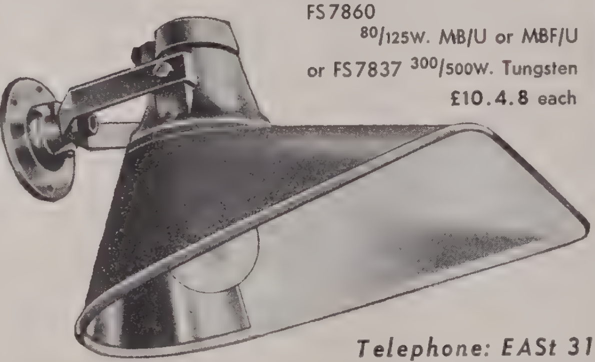

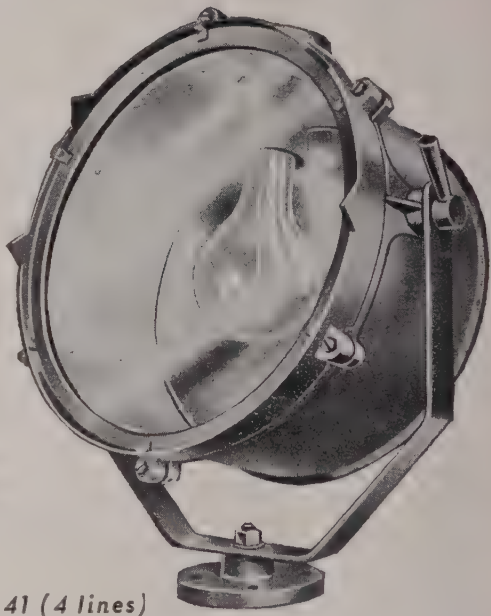

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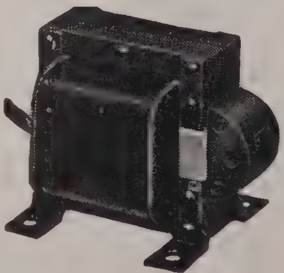

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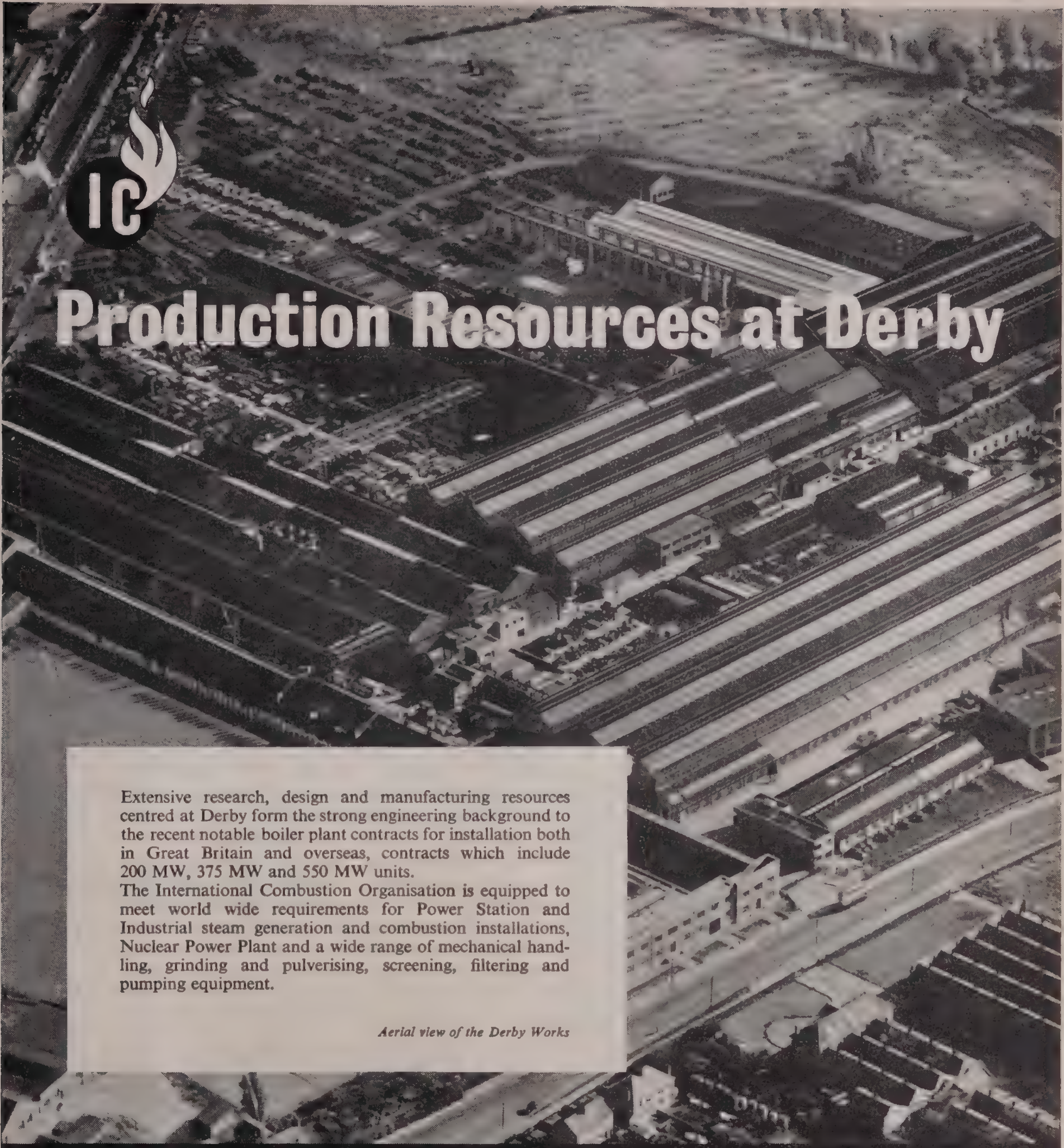

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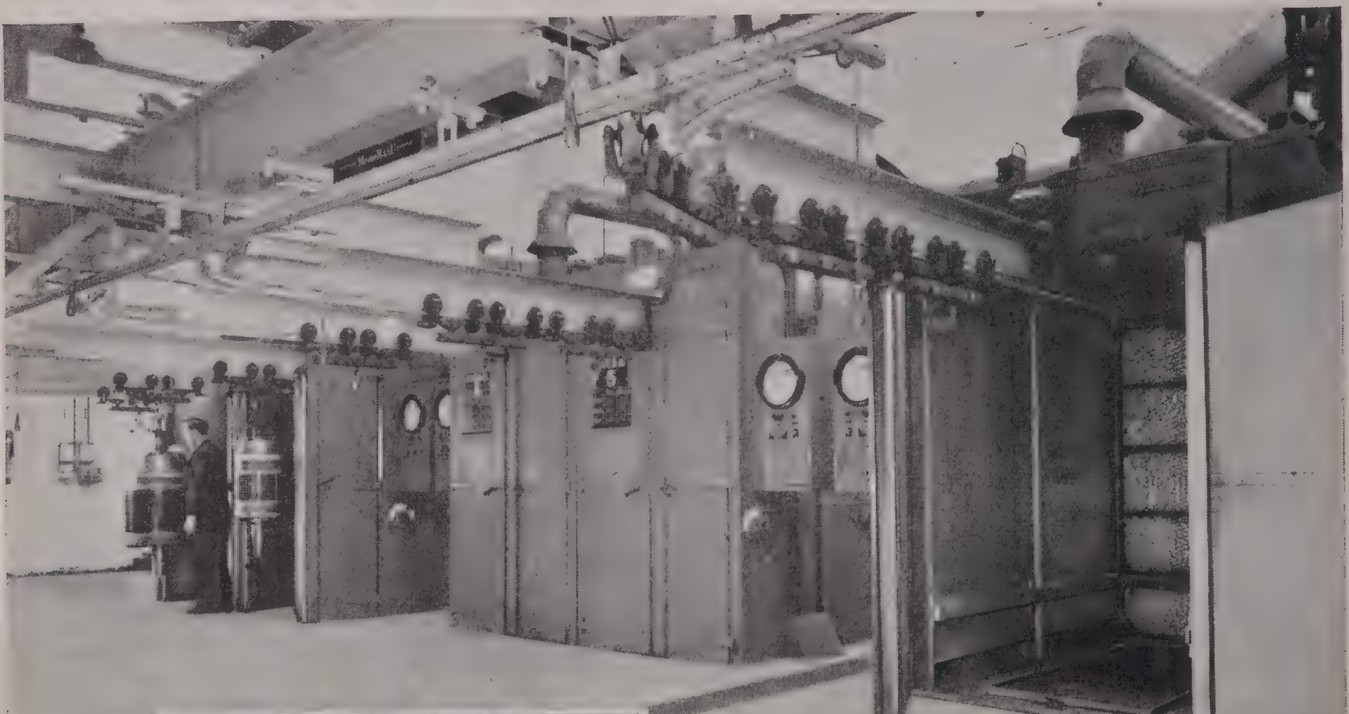

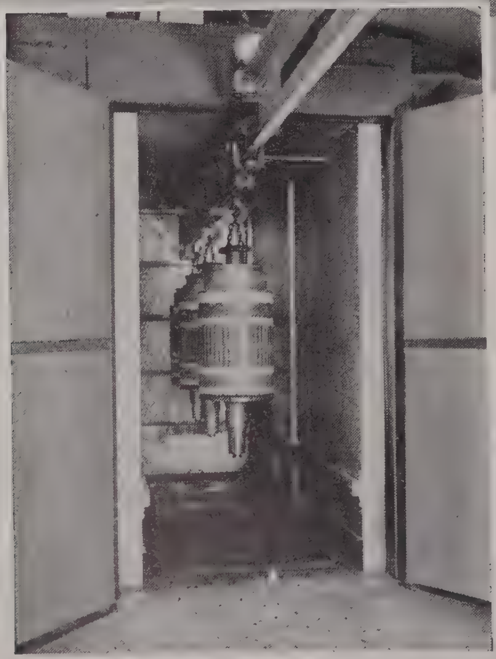

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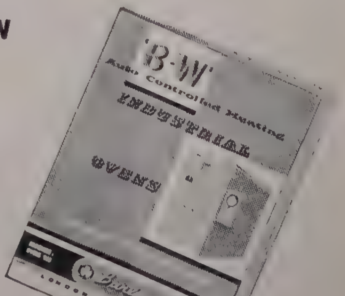

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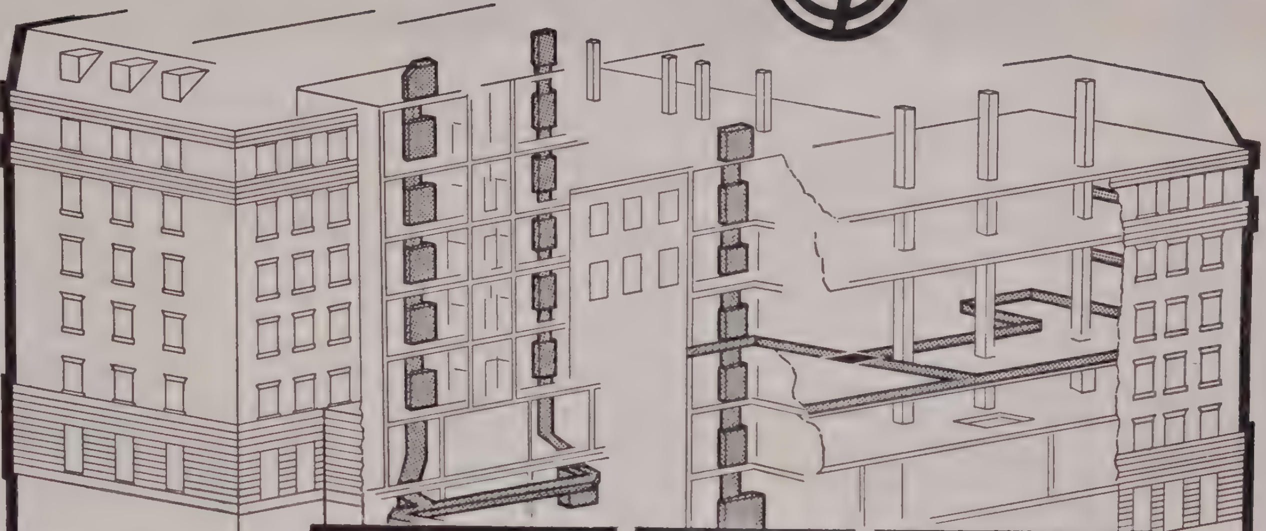

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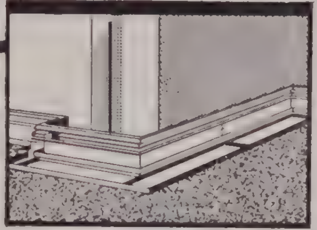

Section of Skirting Floor Trunking in course of installation.

One of the 21 Switchboards in use in this building.

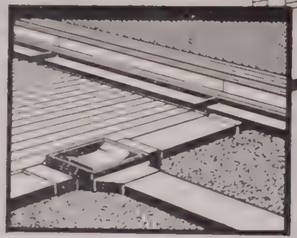

Illustration shows, Underfloor trunking and Skirting trunking serving floor heating.

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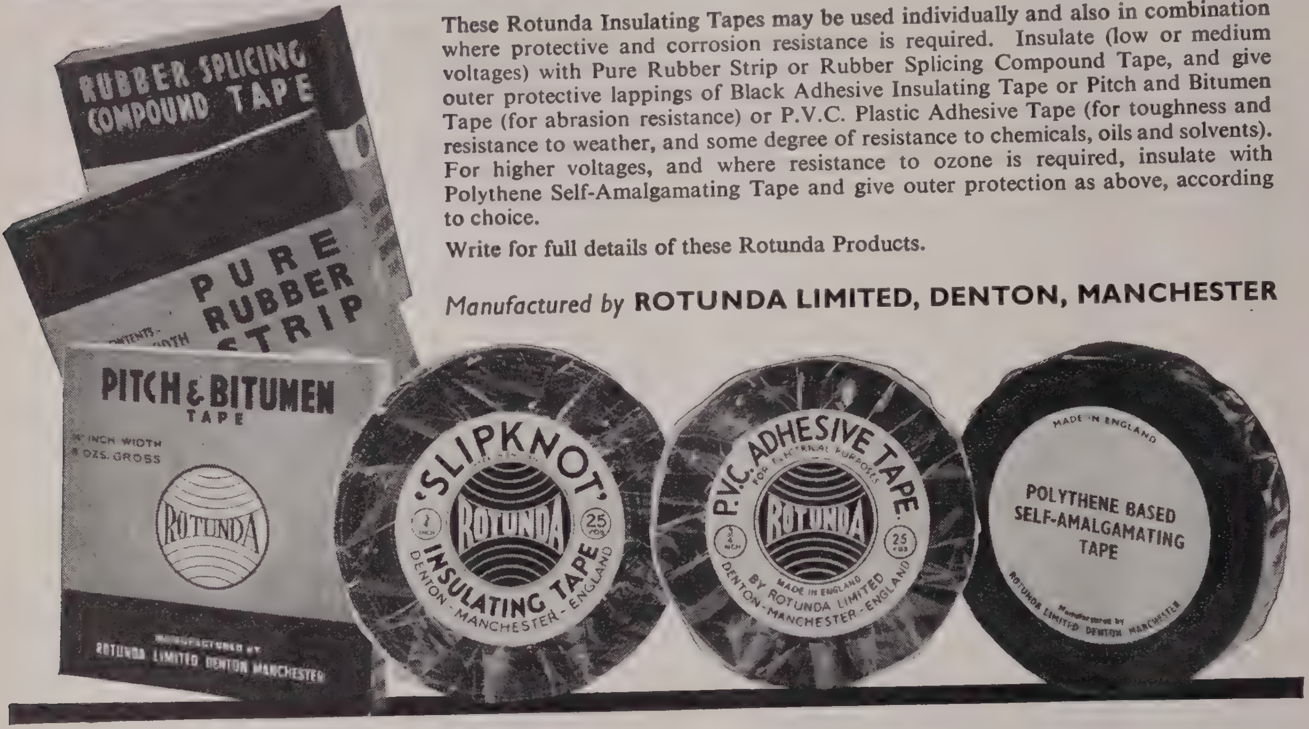
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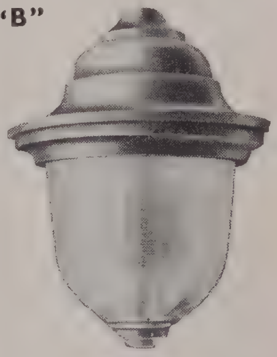

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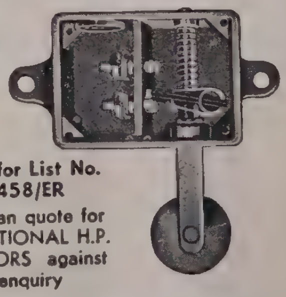

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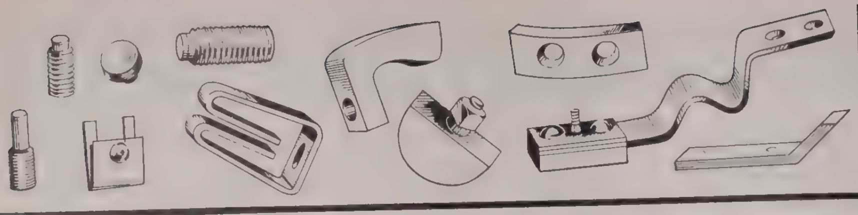

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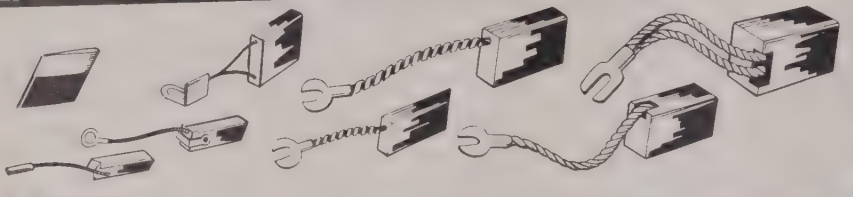

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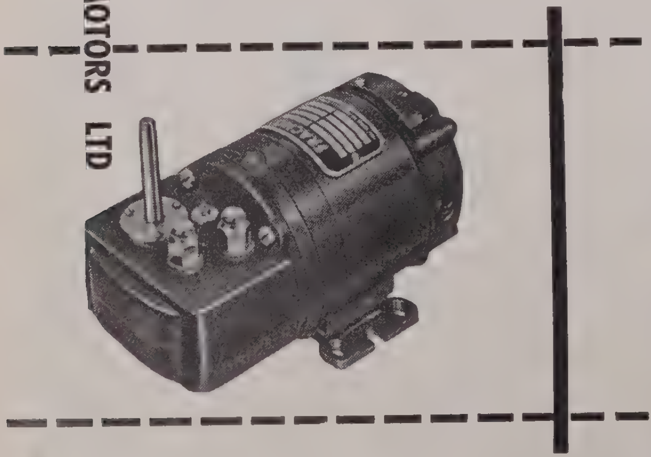

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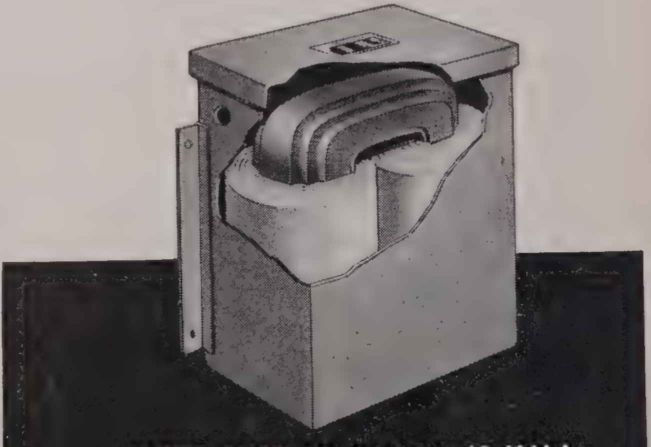

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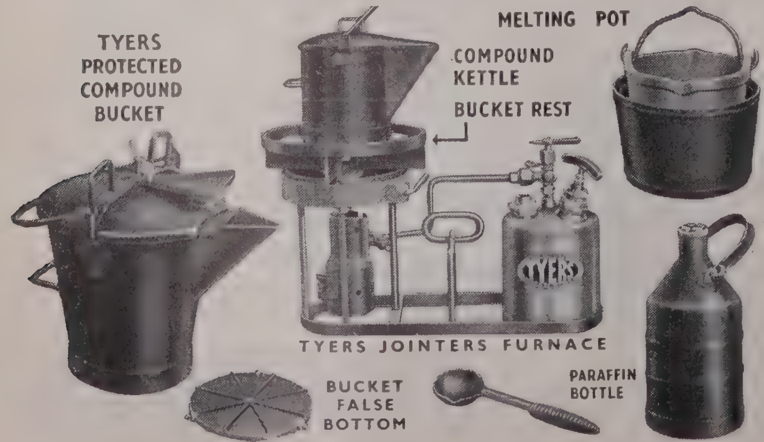

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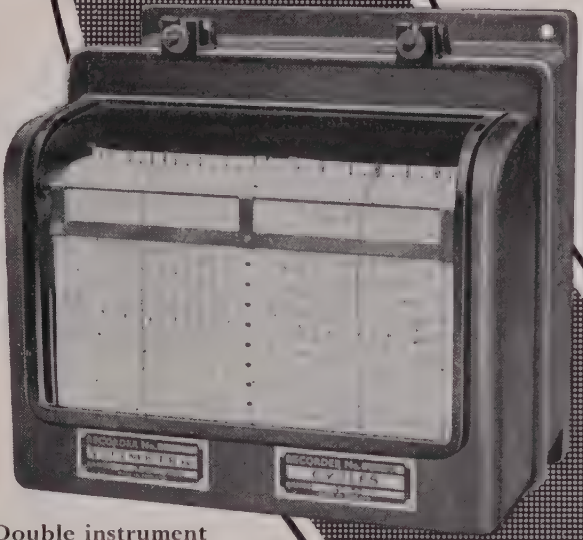

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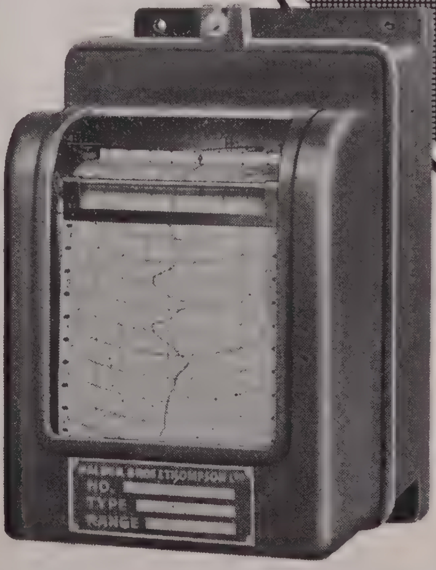

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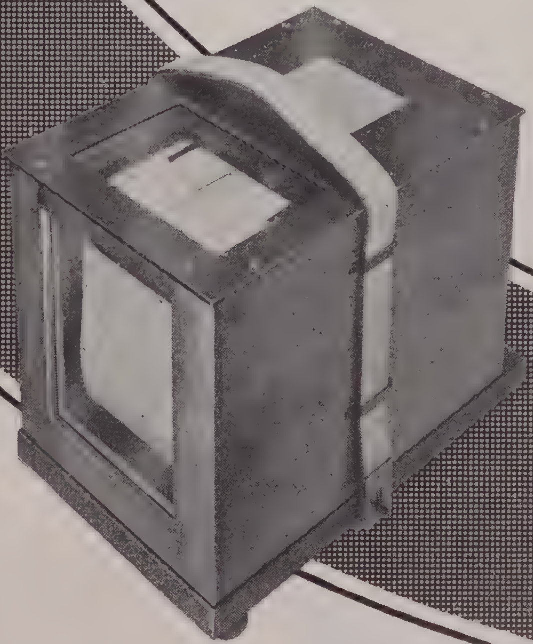

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Dalston Lane Works–London E.8

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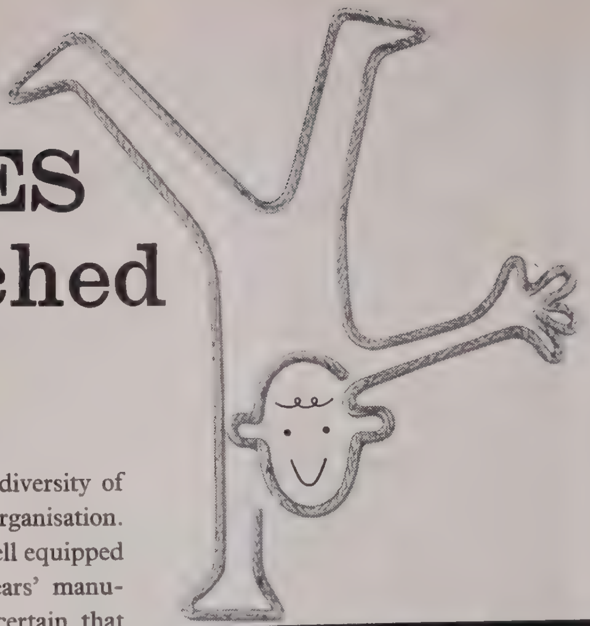
2365 (4 lines)

Q

LIVE WIRES get attached to Kent...



Low tension electrical porcelain products in a diversity of designs pour out by the million from the Kent organisation. Whatever your requirements may be, we are well equipped to meet all your demands. With over 80 years' manufacturing experience to rely on, you can be certain that a Kent product can be specified with safety.

KENT
electro-ceramics

WILLIAM KENT (PORCELAINS) LTD.
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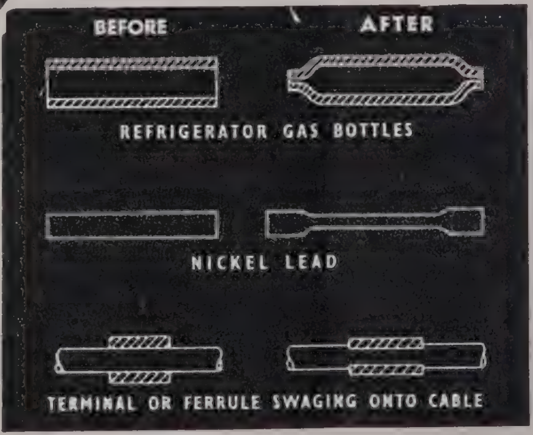
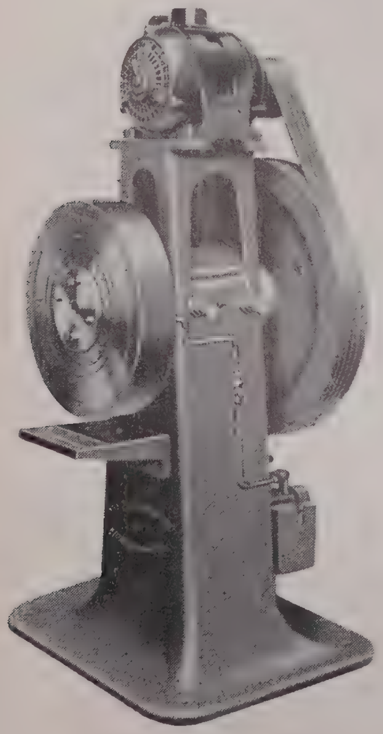
ENQUIRIES ON ALL ELECTRO-CERAMICS ARE WELCOME.

WRITE FOR OUR ILLUSTRATED CATALOGUE.

Can ROTARY SWAGING help YOU?

Examples of the type of work for the ELECTRICAL TRADE





SAVE MONEY TIME AND MATERIAL

- No wastage of material
- Operated by unskilled labour
- Cheapest and Quickest method

Rotary Swaging is a means of reducing, tapering or pointing rod, tube and wire, and is essentially a hammering operation, the rapidity of the blows producing a fine finished surface, toughening the material and increasing its tensile strength. It is used extensively for electrical elements, and is better for manipulating tungsten, molybdenum and nickel.

SEND FOR FULL PARTICULARS—***It might solve your problem***

STEVENS & BULLIVANT LTD.
Western Road · BIRMINGHAM 18

Telephone:
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Telegrams:
"Swager, Birmingham"

HADDON

STANDARD

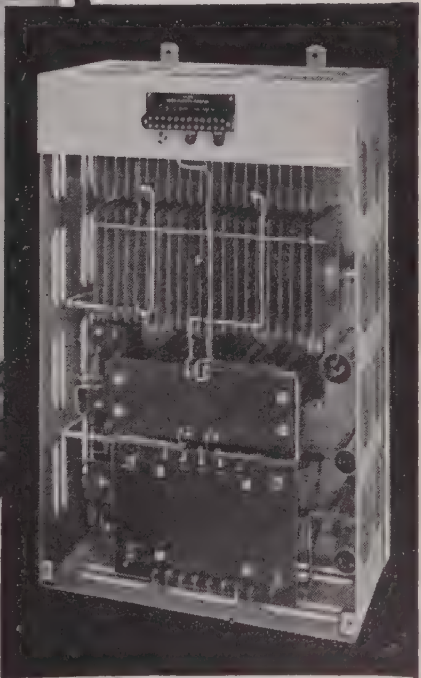
SATURABLE REACTORS

TRANSDUCTORS

Haddon "**STANDARD**" Saturable Reactors — Transductors operate from conventional A.C. line Voltages and provide a choice of D.C. Voltages for Control Windings. Selected from a wide range of individually designed and manufactured **SPECIALS** over past years. The **HADDON STANDARD RANGE** enables the discerning engineer to select **STANDARD EQUIPMENT** for Specific application.

416 standard single phase designs cover the range 1 kVA to 300 kVA.

They provide the best method of stepless control in both long term economies and high performance standard.



Technical literature containing the principles and applications of our wide range of Saturable Reactors is available on request.

MAGNETIC AMPLIFIERS

For use with Saturable Reactors Haddon manufacture a standard line of Magnetic Amplifiers.

Operating from 200/250V 50/60 c/s single phase supply, with input of 0-5 mA. DC in 2000 8000 ohms.

Illustrated above is the 1000W. Magnetic Amplifier.

HADDON

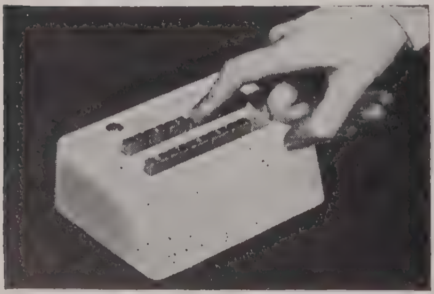
HADDON TRANSFORMERS LIMITED

Victoria Park Industrial Estate, Field End Road, Ruislip, Middx.

Telephone: *Byron* 9444-8 *Telegrams*: *Hadtrans, Ruislip*

IMMEDIATE CONTACT INDOORS OR OUT

the best Wireless Paging System



The tiny NIRA receiver in an executive's pocket gives him freedom of movement which is invaluable. Wherever he goes about the premises—to other offices or workshops, out to the transport yard—he remains always within call. No time wasted by irritating waiting for telephone calls or visitors who may not come. He and his colleagues are connected by invisible links which can be forgotten until the moment they are needed.

The NIRA system is simple and dependable. The receivers are recharged automatically when not in use—no dry batteries are used, for greater reliability and low maintenance costs. Calling is a matter of pressing a button marked with the executive's number—only the person called receives the signal.

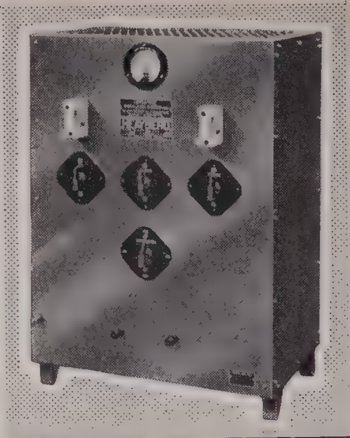
NIRA is far in advance of all other systems. Easier operation—lower installation costs—Receivers which are lighter, neater—more sensitive—fully guaranteed.

Write for the Nira illustrated folder to:

CASS ELECTRONICS LTD

CHERTSEY, Surrey *Telephone: Chertsey 3487*

Battery Chargers



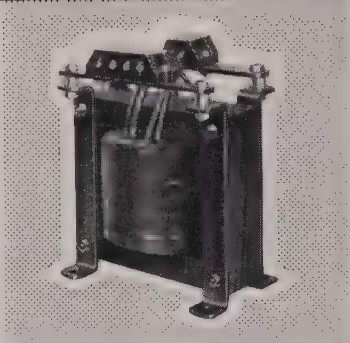
Whatever rate of charge you need, Heayberds have the model to supply it.

The range of Heayberd Battery Chargers is designed to meet the needs of every type of Garage. They give a rapid and continuous charging rate and can be operated for long periods. Thoroughly reliable they give years of service.

Write now for list 1048 for details of the Heayberd range of Industrial Battery Chargers.

HEAYBERD QUALITY PRODUCTS

Transformers



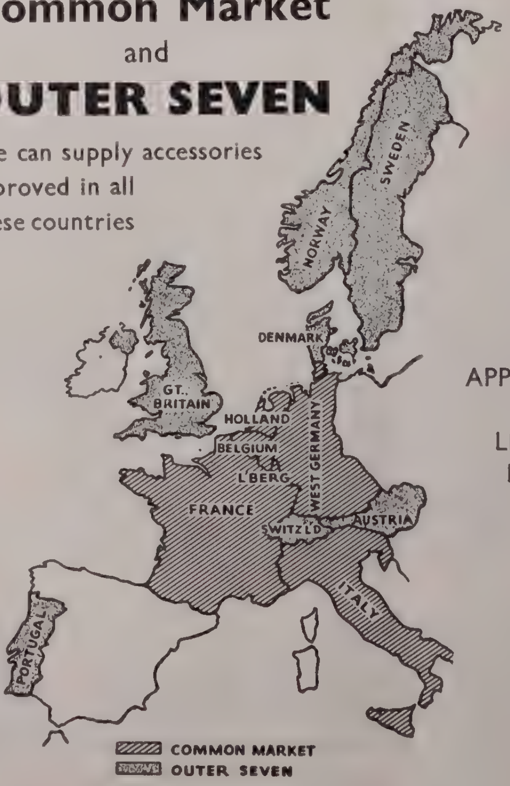
This same reliability is found in Heayberd transformers. Step-up and step-down transformers are available for all duties to current B.S. Specifications 171 and 794.

Write now for full details to:—

F. C. HEAYBERD & CO. LTD.
GREENWICH SOUTH STREET, S.E.10
Phone: *Tideway 4646* Telegrams: *"Heayberd, London, S.E.10"*

Common Market
and
OUTER SEVEN

We can supply accessories approved in all these countries

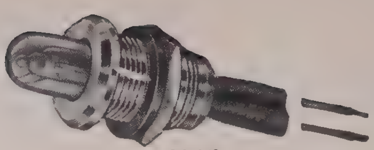


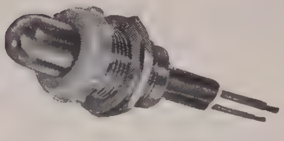
for
APPLIANCES
and
LIGHTING
FITTINGS

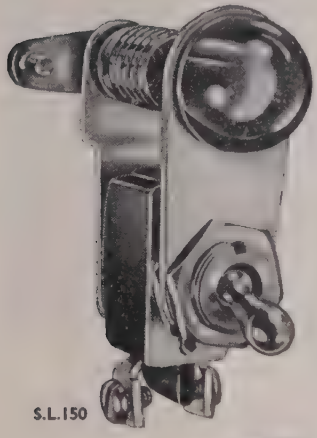
WALTER LOGAN & CO. LTD.

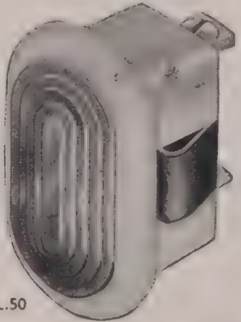
34 Oak Tree Drive, Totteridge
London, N.20. *HILlside 7319*

Arcolectric Signal Lamps

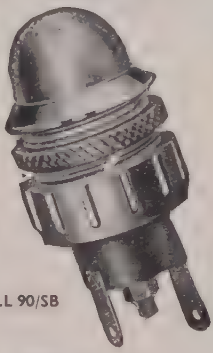

S.L.162

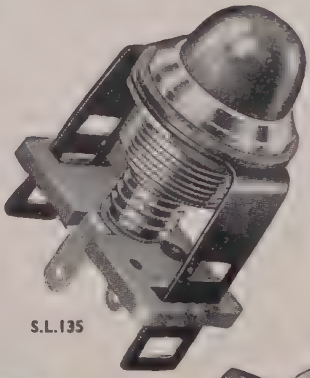

S.L.160


S.L.150


S.L.50

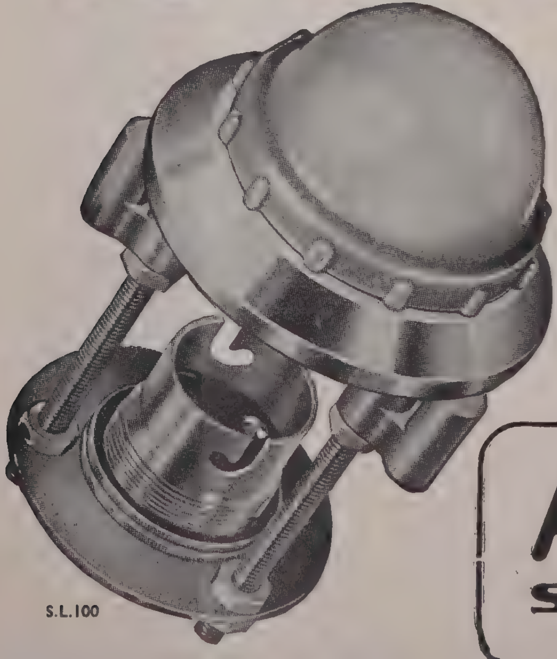
S.L.130


S.L 90/SB


S.L.135

S.L.86

S.L.82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Neon for 80—600 volts

S.L.162 and S.L.160 : New miniature low cost neon signal lamps. ¼″ hole fixing. Completely sealed against moisture.

S.L.50 : Snap-in fixing.

Low Voltage

S.L.130 : New high quality design for M.B.C. (M.C.C.) bulbs. Also available with M.B.C. neon.

S.L.90/SB : Popular M.E.S. holder. Services No. 10AE/413.

S.L.135 : Adjustable M.E.S. holder.

S.L.150 : Combined toggle switch and M.E.S. signal lamp.

S.L.82 : M.E.S. holder ZA 4201.

S.L.86 : Low cost M.E.S. holder.

Mains

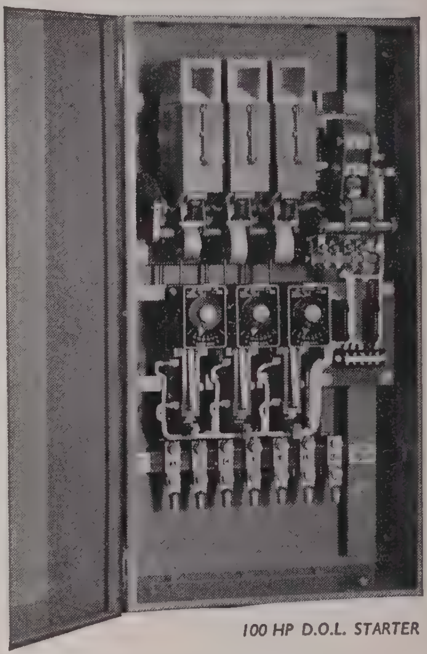
S.L.100 : For 15 watt B.C. sign lamps.

A similar but smaller S.B.C. holder is available for S.B.C. 10 watt lamps.

Write for Catalogue No. 132

ARCOLECTRIC
SWITCHES · LTD

CENTRAL AVENUE · WEST MOLESEY · SURREY · Tel.: MOLESEY 3232



LG A.C. AUTOMATIC CONTROL GEAR

- Contactors from 10 to 1200 amps
- Industrial and Marine Starters
- VAPORMATIC slip ring starters
- Multi-motor Boards
- ASTA tested range and complying with BSS 587 and 775
- Competitive Prices and Quick Deliveries

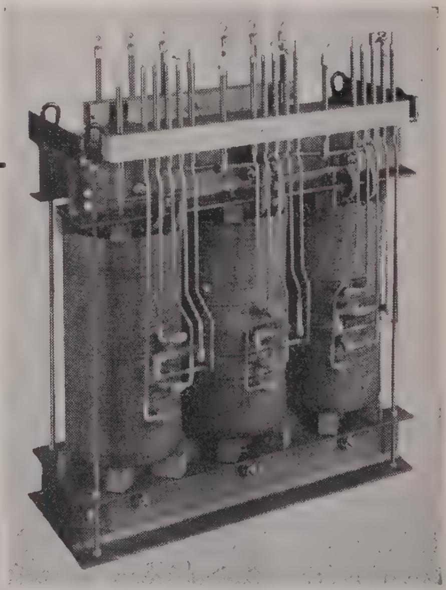
LEE GUINNESS LTD.

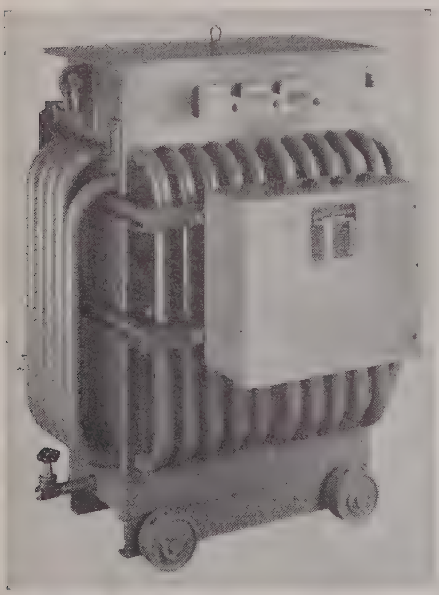
WORKS: NEWTOWNARDS, N. IRELAND

100 HP D.O.L. STARTER

Enquiries to: **MAIN SALES OFFICE, 25 VICTORIA STREET, LONDON, S.W.1**
TEL: ABBEY 6762/3 TELEX 23687

LGI 6197





THE COMPLETE TRANSFORMER SERVICE

We offer

- Electronics Division up to 10 KVA
- Power Division up to 500 KVA
- Metal Working Division Instrument Cases Cubicles, Tanks, etc.
- Resin Encapsulation Division

Enquiries to Technical Sales

A.I.D. and A.R.B. R.C.S.C.
Certificate No. 1160/1

WILLESDEN TRANSFORMER CO. LTD.
MANOR PARK WORKS, MANOR PARK ROAD, HARLESDEN, LONDON, N.W.10
TELEPHONE: ELGAR 5445-6

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).

DISPLAYED CLASSIFIED:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Cheques and Postal Orders should be crossed and made payable to ILIFFE ELECTRICAL PUBLICATIONS LTD.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF BELFAST ELECTRICITY DEPARTMENT

STORES

TENDERS are invited for the supply of the undermentioned materials during 12 months commencing 1st May, 1961 :—

Form No.

22. Bare Hard Drawn High Conductivity Copper Conductors and P.V.C. Insulated Cables.
23. Street Lighting Fittings, Steel and Concrete Poles and Ancillary Equipment.
24. Transformer Kiosks with High and Low Tension Switchgear.
25. Overhead Line Equipment.
26. Mineral Insulated Copper Sheathed Cables and Terminating Accessories.
27. Repairs to Thermal Insulation.
28. Bitite Strip, Prepared Tape for Joints, Joint Box Compounds and Refined Bitumen.
29. Rubber Insulated and P.V.C. Insulated Cables and Flexible Cords.
30. Lamps.
31. Oilskin or Plastic Clothing, Tarpaulins, Rubber Jointings, etc.
32. Electric Immersion Water Heating Equipment and Hot Water Cylinder Insulating Jackets.
33. Alkaline Switch Tripping Batteries and Charging Equipment.
34. 6,600-volt Ring Main and Switch Fuse Units.
36. Electrical Accessories and Kettle and Washboiler Elements.
37. Boiling Plates for Electric Cookers.
38. Medium Voltage H.R.C. Cartridge Fuse Links.
39. Imported Red Fir Wood Poles.

Note.—Forms Nos. 29, 30 and 31 are in respect of materials which shall be supplied to any Department of the Corporation.

Forms of tender may be obtained from the Electricity Department, East Bridge Street, Belfast, 1, on payment of the sum of ten shillings (non-returnable) for each form. Extra copies of the forms may be obtained at five shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

Tenderers are advised that the Corporation conditions of contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Tenders, in sealed envelope marked "Tender for Stores, Electricity Committee," and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on FRIDAY, 17th FEBRUARY, 1961.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

P.O. Box 234,
City Hall, Belfast, 1.
7480

CLASSIFIED ADVERTISEMENTS ARE PREPAID

CITY OF SALFORD

TENDERS are invited for the supply and delivery of the following materials during the period 1st April, 1961, to 31st March, 1962 :—

(1) 15-ft. Concrete Columns.
(2) 60-watt Sodium Vapour Totally Enclosed Lanterns with ancillary equipment.
(3) 100-150-watt Class "B" Totally Enclosed Lanterns.
(4) Time Switch and Fuse Boxes.
(5) Synchronous Time Switches (solar dial).

Applications for forms of tender to be made to the Street Lighting Superintendent, 9, Frederick Road, Pendleton, Salford, 6. Tenders in plain sealed envelopes endorsed "TENDERS FOR STREET LIGHTING EQUIPMENT" must be returned addressed to the Chairman, Highway and Street Lighting Committee, Town Hall, Salford, 3, not later than 5 p.m. on Tuesday, 21st February, 1961.

The Corporation does not bind itself to accept any or the lowest tender.

R. RIBBLESDALE THORNTON,
Town Clerk.

Town Hall, Salford, 3.
7442

BOROUGH OF WIDNES

THE Corporation invite tenders for the supply of the undermentioned materials required in the Highways Department during the twelve months ending 31st March, 1962:—

1. Electrical Equipment.
2. Electric Lamps.
3. Gas Fittings and Mantles.

Forms of tender, specification and envelopes in which the tenders must be submitted may be obtained from F. A. J. Knight A.M.I.C.E., M.I.Mun.E., Borough Engineer and Surveyor, Town Hall, Widnes.

Tenders in envelopes provided to be forwarded to reach the undersigned not later than 9 a.m. on Thursday, 16th February, 1961.

The Council do not bind themselves to accept the lowest or any tender.

FRANK HOWARTH,
Town Clerk.

Town Hall,
Widnes, Lancs.
7463

CONTRACTS

THE HERTFORDSHIRE COUNTY COUNCIL invite applications for inclusion on their List of Contractors for building and maintenance works, heating and electrical works, fencing works, etc. Tenders will normally be invited from a number of firms on the list, but the County Council reserve the right to ask for other tenders.

Application forms from the Clerk of the County Council, County Hall, Hertford.

Contractors who have already applied for inclusion on the list need not apply again.

7464

BOROUGH OF EALING

Renewal of Electrical Installations at Drayton Infants' School and Perivale Primary School

TENDERS are invited from approved N.I.C.E.C. contractors for the above-mentioned work. Specification and tenders from Borough Engineer, Town Hall, Ealing, London, W.5, on receipt of deposit of £1 each, returnable on receipt of a bona fide tender.

Closing date 23rd February, 1961.

E. J. COPE BROWN,
Town Clerk. 7440

Advertisements are accepted up to **first post on Monday** of the week of issue

If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

GHANA SUPPLY COMMISSION

Tenders for Supply of Electric Generating Set

THE GHANA SUPPLY COMMISSION invites manufacturers or, if they cannot themselves quote, their exclusive distributors/sales representative or accredited sales agents in Ghana, to submit tenders for the following:—

Tender Ref. Army 4008/1 :
Electric Generating Set, diesel engine driven.

Forms of tender and conditions of contract are obtainable as from 23rd January, 1961, on payment of a fee of £G.1, from the Secretary, Ghana Supply Commission, P.O. Box M.35, Accra, Ghana.

The closing date for the receipt of tenders will be 23rd February, 1961. 7330

DUFFIELD PARISH COUNCIL

Trunk Road Lighting: A.6, Duffield Road

TENDERS are invited for the supply and erection of 74 Concrete Columns, complete with 140-watt Sodium Lamp Lanterns.

Specification, bill of quantities and form of tender may be obtained from the Clerk to the Council, on payment of a deposit of £2, which will be refunded on receipt of a bona fide tender.

Tenders to be returned in plain sealed envelopes endorsed "Trunk Road Lighting, Parish of Duffield," to the undersigned not later than 6th February, 1961.

L. A. STILES,
Clerk.

30, Wirksworth Road,
Duffield, Derbyshire.
7446

DURHAM COUNTY COUNCIL

TENDERS invited :—

Wingate New Secondary Modern School: Electrical Installation.

Application for further details to County Architect, South Street, Durham, not later than 8th February, 1961.

J. K. HOPE,
Clerk of the County Council.

Shire Hall,
Durham.
7481

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

LIGHTING INSTALLATION PLANNER

required (min. age 23/24) as an assistant in the Illuminating Engineering Service Department. Applicants should have electrical background or experience. Residence within easy reach of Tottenham is desirable.

Apply stating age, experience and salary required to :—

The Chief Lighting Engineer
THE BENJAMIN ELECTRIC LIMITED
Brantwood Road, Tottenham
London, N.17

7439

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

GENERAL ASSISTANT ENGINEER (Chemist), HIGH MARNHAM POWER STATION (Vacancy No. 5/61).

Applications are invited for the position of General Assistant Engineer (Chemist) at High Marnham Power Station, near Newark, Notts.

Candidates should possess the Ordinary National Certificate in Chemistry as a minimum qualification, and should have previous experience in the analysis and testing of coal, water and oil, preferably in a power station laboratory.

The salary will be within the range £625-£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 3rd February, 1961.

ASSISTANT MAINTENANCE ENGINEER (Electrical), HIGH MARNHAM POWER STATION (Vacancy No. 6/61).

Applications are invited for the position of Assistant Maintenance Engineer (Electrical) at High Marnham Power Station, near Newark, Notts.

Applicants should have received a sound training in electrical engineering.

Previous experience in electrical maintenance and a knowledge of planning procedure is desirable.

Salary will be in accordance with Class M, Grade 8 (£1,440-£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 3rd February, 1961.

PLANT SHIFT CONTROL ENGINEER, DRAKELOW "B" POWER STATION (Vacancy No. 12/61).

Applications are invited for the position of Plant Shift Control Engineer at Drakelow "B" Power Station, near Burton-on-Trent, Staffs.

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National standard desirable.

Salary will be in accordance with Class L, Grade 10 (£1,190-£1,325 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th February, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned and should be returned to him not later than the date stated.

O. S. WOODS,
Divisional Controller.

7475

STAFFORDSHIRE COUNTY COUNCIL EDUCATION COMMITTEE

Cannock Chase Mining and Technical College

Principal: J. E. Greenhalgh, B.Sc.(Eng.), A.M.I.Mech.E., A.F.R.Ae.S.

APPLICATIONS are invited for the post of SENIOR LECTURER in the Engineering Department. He should be competent to teach the subject of Electrical Engineering to Higher National Certificate students and be responsible to the Head of the Engineering Department for all electrical engineering courses in the department. Candidates should have a University Degree, with industrial and teaching experience.

Salary will be in accordance with the Burnham (Technical) Scale for Senior Lecturers, viz.: £1,550 × £50 to £1,750 per annum.

In certain circumstances allowances towards cost of lodging and removal expenses may be made to married teachers.

Form of application, returnable by 17th February, 1961, together with further particulars relating to the above appointment, may be obtained from the Director of Education (Staffing), County Education Office, Stafford, on receipt of a stamped addressed envelope.

7465

THE ZENITH ELECTRIC CO. LTD.

ZENITH WORKS, VILLIERS ROAD, LONDON, N.W.2

Invite applications for the positions mentioned below. Salaries will be commensurate with experience gained in each sphere and age need not necessarily deter application provided the ability to satisfy our requirements can be proved. We are a compact unit and service with us will provide variable experience.

DESIGNERS to cover single phase and three phase TRANSFORMERS up to approximately 45 kVa. Ability to handle chokes, rheostats and potentiometers would make these positions interesting.

TEST ROOM Person to take charge of Transformers, including the well known "VARIAC", Chokes and small equipments. This position is suitable for the maturer person with initiative and tact who seeks a post with varied testing.

DRAUGHTSMAN Senior electro mechanical design draughtsman with experience in the field of small electrical equipments and transformers.

All the above are staff positions and would qualify for our pension scheme. The usual five day week operates. Apply in writing to the above address or telephone Willesden 6581, Etn. 7, for an appointment. 7391

AEI

Associated Electrical Industries Limited

Switchgear Division

SALES ENGINEERS

Associated Electrical Industries Limited have vacancies for SWITCHGEAR SALES ENGINEERS (inside) at Higher Openshaw, preferably H.N.C. or higher standard, to deal with enquiries and orders for power station and substation switchgear. Applicants should have switchgear experience. Please write giving brief details of career, quoting reference B.18 to:—

The Personnel Officer
Associated Electrical Industries Limited, Switchgear Division
Higher Openshaw, Manchester, 11

7445

ELECTRICAL MAINTENANCE SUPERVISORS

are required by TEXACO TRINIDAD, INC.

for service in TRINIDAD

Applicants who should be keen to make a career in the oil industry in the West Indies must be between 26 and 35 years of age and have the following qualifications and experience:—

Ordinary National Certificate in Electrical Engineering, a full apprenticeship, ability to drive and knowledge of the electrical maintenance and installation of industrial flameproof motors, manual and automatic starters, electrical tools, welding equipment, substation switchgear up to 6·6 kV and conduit installation practice.

They must also be able and prepared to organise and train labour and if necessary carry out some of the work themselves. Starting salary will be in the region of £1,400 p.a.

Texaco Trinidad, Inc. provides cheap married and single accommodation, excellent clubs and facilities for sport, schooling for children, comprehensive medical arrangements and a pension scheme.

Write with brief particulars only in the first instance to:—

The Personnel Officer
TRINOIL (U.K.) LIMITED
29/30 Old Burlington Street, London, W.1

7474

YORKSHIRE ELECTRICITY BOARD

Head Office

COMMERCIAL DEPARTMENT
SENIOR ASSISTANT ENGINEER
(Tariffs and Statistics).

A vacancy exists for a statistician to take charge of the Statistics Section of the Commercial Department at Head Office. Applicants should possess a qualification in statistics or mathematics and have had practical experience in statistical work. The work involves responsibility for the collection and collation of statistics, for sampling surveys and for the interpretation and assessment of results. Candidates must have a working knowledge of statistical techniques and particularly of correlation analysis.

Salary N.J.B. Class BX, Grade 2, within the range £1,695/£2,085 per annum.

PRINCIPAL ASSISTANT
(Personnel).

The successful applicant will be required to assist in matters of employment and labour relations in the Personnel Section of the Secretary's Department at Head Office.

Candidates should have a sound experience of recruitment and selection procedure, personnel records and statistics and manpower establishments. A detailed knowledge of the wage and salary agreements and an appreciation of the negotiating machinery is essential.

An appropriate professional qualification would be an advantage.

Salary N.J.C. Grade 7, £1,250/£35/£1,355 per annum.

Applications with the names of two referees, should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Leeds, not later than 6th February, 1961.

No. 6 (Hull) Sub-Area

THIRD ASSISTANT ENGINEER
(Construction).

Applicants should have had experience in primary substation and system construction work with particular reference to cable work at all voltages. The successful applicant will be required to assist in the supervision of the construction of primary substations generally and to investigate cabling problems throughout the Sub-Area.

Possession of technical qualifications to the minimum of the Graduateship of the Institution of Electrical Engineers is essential.

Salary N.J.B. Class L, Grade 1 (Scale 10), £1,190/£1,325 per annum.

Applications with the names of two referees, should be sent to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 10th February, 1961.

No. 3 (Sheffield) Sub-Area

SHEFFIELD WEST DISTRICT
THIRD ASSISTANT DISTRICT ENGINEER.

Applicants should possess a Higher National Certificate in Electrical Engineering or equivalent qualifications, and have had experience in the work of a district engineering department.

Salary N.J.B. Class J, Grade 9 (Scale 9), £1,115/£1,245 per annum.

Applications with the names of two referees, should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 10th February, 1961. 7482

WE REQUIRE
CONTROL GEAR SPECIALISTS
for

- LIFTS.
- CRANES AND HOISTS.
- HEATING AND VENTILATING.
- AIR CONDITIONING AND REFRIGERATION.

You may be one of the men we are looking for. We are one of Britain's most progressive manufacturers of motor control gear and we are looking for additional Sales Engineers to help with our steady expansion.

You will be well paid, receive a generous car allowance, and be eligible immediately for our non-contributory pension scheme. You will join a young and vigorous team and be given the benefit of a first-class sales training programme.

Write with full details to :—

M.T.E. CONTROL GEAR LTD.
Leigh-on-Sea, Essex

7417

RTB

RICHARD THOMAS & BALDWINS LIMITED

SPENCER WORKS

Vacancies exist for

ELECTRICAL DRAUGHTSMEN

in the Electrical Engineers' Department at Spencer Works, now under construction at Llanwern, near Newport, Mon.

Applications are invited for these positions to assist in the design, development, and layout of plant and installations associated with the manufacture of iron, steel, and finished products. Candidates, who should be between the ages of 21 and 45, will be responsible to the Chief Electrical Draughtsman. Preference will be given to those candidates with Ordinary National Certificate in electrical engineering.

The range of specialisation is not rigid, but applicants should be trained and experienced in development and layout work associated with steelworks, rolling mills, and finishing departments of modern composite plants, or comparable installations in medium or heavy industrial engineering.

Application forms, which should be returned by February 3, 1961, *can be obtained from*

The Manager
Staff & Labour Relations Department
Richard Thomas & Baldwins Limited
Spencer Works, Llanwern
Nr. Newport, Mon.

Please quote reference 839/*A in your original letter of application.* 7456

JUNIOR ELECTRICAL ENGINEER

required for an interesting and progressive post in East London.

Candidates should be about 25 years of age, apprentice trained, and have a strong flair for magnetism and electronics. Preference will be given to I.E.E. graduates. The man appointed will be concerned with the development of aluminium foil conductors for solenoid and other applications in the D.C. and A.C. fields.

This is a staff position with membership of the company's pension fund, five-day week and canteen facilities. The salary payable will be in accordance with ability and experience.

Please supply full details of age, education and experience to Personnel Manager, Venesta Foils Limited, North Woolwich Road, Silvertown, London, E.16. 7450

A.C. MOTOR DESIGNER/DRAUGHTSMAN

up to or approaching H.N.C. standard, age 20-25 years, to work with Senior Designer on complete design problems, electrical and mechanical, associated with orthodox and special induction motors.

YOUNG DESIGNER/DRAUGHTSMAN

up to or approaching H.N.C. standard, and with good all-round electrical engineering adaptability, for interesting work under Senior Designer on motor control gear and associated equipment embracing the use of modern light current and electronic components.

Write giving details of age, experience and technical background to

The Secretary
BRITISH JEFFREY-DIAMOND LTD.
Wakefield

7448

SOUTH EASTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER,
Twickenham and Richmond District.

Salary scale at present N.J.B. Class F, Grade 5, £1,190 to £1,325 per annum plus London allowance, with progression to Grade 4 (maximum salary £1,410) subject to satisfactory service (reclassification to Glass G anticipated in 1961).

Successful candidate will be responsible to the District Commercial Engineer and will be required to assist with tariff negotiations, sales activities, contracting, public lighting and general load development. Applicants must have suitable experience and should preferably possess a Higher National Certificate in Electrical Engineering or its equivalent. Consideration will be given to a private car allowance.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 42, York Street, Twickenham, Middlesex, by 8th February, 1961.

ASSISTANT DISTRICT COMMERCIAL ENGINEER (Contracting),
Tunbridge Wells District.

Salary £825-£940 per annum under N.J.B. Class F, Grade 10. Superannuable. The candidate appointed will be an assistant to the engineer responsible for electrical installation contracting work in the District, and his duties will include the preparation of estimates and schemes for contracting work. Possession of the H.N.C. in Electrical Engineering would be an advantage.

Applications, quoting ER and naming two referees, to District Manager, SEEBOARD, Town Hall, Tunbridge Wells, by 6th February, 1961.

SHOWROOM SUPERVISOR,
Thanet District.

Salary £780 × £25 to £880 p.a. under N.J.C. Grade 3. Superannuable. Applicants should have an extensive knowledge of showroom procedure, display techniques, sales promotion, stock control, the application of tariffs, and be experienced in the supervision of sales staff. Possession of the E.D.A. salesmanship qualifications is essential. The successful candidate may elect to have a service tenancy of a Board flat. The successful applicant will normally be required to do duty in the Margate showroom, but he may be called to work elsewhere within the Thanet District.

Applications, quoting ER and naming two referees, to District Manager, SEEBOARD, Electricity Offices, St. Peter's, Broadstairs, Kent, by 8th February, 1961.

GEORGE WRAY,
Secretary. 7476

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER
(Planning), POST A
and
THIRD ASSISTANT ENGINEER
(Technical), POST B

required in the Chief Engineer's Department at Board Headquarters, Love Lane, Pall Mall, Liverpool, 3. Commencing salary at a suitable point within the range :—

Post A, £1,375/£1,610 p.a. (N.J.B. AX/5).
Post B, £1,105/£1,325 p.a. (N.J.B. AX/8).

It is anticipated that the Board's classification will be increased to BX in the near future, when the appropriate salary will be within the range :—

Post A, £1,375/£1,720 per annum.
Post B, £1,105/£1,410 per annum.

Applicants for POST A should have a good knowledge of distribution systems at all voltages and a good understanding of the associated economic factors.

Applicants for POST B should have good experience in the use of instruments and recorders, knowledge of telephone equipment, and the planning and operation of communication systems, including V.H.F. radio. The successful applicant will be required to undertake special investigations in the field of communication and measurement.

In both posts technical qualifications are desirable.

Appointments subject to medical examination. Pension scheme.

Applications for either post should be made on forms obtainable from the Establishments Officer at the above address. Closing date, 10th February, 1961. 7469

***Situations Vacant** (continued)*

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

Central Gloucestershire Sub-Area

DEMONSTRATOR (Female)
(Dean Forest).

Applicants must have had a good education and should have a certificate of a recognised domestic training college and/or the E.A.W. Certificate. Some selling experience would be an advantage. Duties include lecture demonstrations in service centres and on consumers' premises and advice to consumers on the selection and use of electrical apparatus. Applicants must be prepared to take an active part in the sales organisation. Salary £600/£700 per annum (N.J.C. Grade 1).

Apply by letter stating age, education, qualifications, training and experience to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, Eastern Avenue, Gloucester.

Shropshire and Herefordshire Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (Shrewsbury).

Duties include the construction, operation and maintenance of H.V. and L.V. underground mains and overhead lines and substations, up to and including 33 kV, and the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary £965/£1,090 per annum (N.J.B. Grade E.7). (It is expected that the classification will shortly be raised to F.)

Apply by letter to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

South Staffs. and North Worcs. Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (Stourbridge).

Applicants should have had experience in all branches of district work, including the installation, operation and maintenance of nigh and low-voltage cables, switchgear and transformers. Technical qualifications desirable. Salary £1,040/£1,165 per annum (N.J.B. Grade F.7).

Apply by letter, within 14 days, stating age, qualifications, experience, present position and salary, to Mr. H. A. P. Caddell (ref. EMI/SEC), Sub-Area Manager, Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton, Staffs.

F. W. CATER,
Secretary. 7460

HUDDERSFIELD COLLEGE OF TECHNOLOGY

Principal: Dr. W. E. Scott, M.B.E.

Department of Electrical Engineering

APPLICATIONS are invited for TWO SENIOR LECTURESHIPS in Electrical Engineering. Duties to commence as soon as possible. Applicants should possess a University Degree and/or be Corporate Members of the Institution of Electrical Engineers. Experience in teaching and industry is essential.

One Senior Lecturer will be required to teach up to Final I.E.E., Part III level in Electrical Technology, and in either Electronic Engineering or Electrical Measurements; the other will be required to take courses to the same level in two of the following: Electrical Machines, Electrical Supply and Utilisation of Electrical Plant.

The Senior Lecturers will be expected to initiate and supervise project work carried out in the fourth year of the Sandwich Course for the College Associateships.

Salary (Burnham Scale) £1,550 p.a. by £50 p.a. to £1,750 p.a. The commencing salary will depend upon previous experience.

Forms of application and further particulars obtainable from the Principal, to whom applications should be returned without delay.

H. GRAY,
Clerk to the Governors.

9th January, 1961. 7369

SANGAMO WESTON

Vacancies occur for young men who hold the B.Sc. or Higher National Certificate in

ELECTRICAL ENGINEERING

The posts are concerned with:—

(a) The DEVELOPMENT AND APPLICATION of electro-mechanical devices in the field of electrical measurement. Applicants should preferably have experience in electrical engineering laboratory techniques and in the manipulation of fine mechanisms.

(b) The PREPARATION OF SPECIFICATIONS of electrical measuring instruments to meet customers' requirements and liaison between Development Laboratories and Contracts Department.

The organization is progressive and expanding. A contributory Superannuation Fund and Endowment Scheme is in operation, together with the normal sports, social and welfare facilities.

Salaries will be commensurate with qualifications and experience.

★ Please apply in first instance by letter, stating age, outlining previous experience, and indicating when available, to the Personnel Manager.

SANGAMO WESTON LIMITED

Cambridge Road
Enfield
Middlesex

7441

CITY OF MANCHESTER

APPLICATIONS invited for the following permanent appointment in the office of the City Architect :—

ASSISTANT ELECTRICAL ENGINEER.

The salary is A.P.T. Grade III/IV, £960 to £1,310 per annum, the commencing salary will be according to qualifications and experience.

The department has an extensive programme of municipal building work ahead comprising new abattoirs, libraries, schools, technical colleges, aged persons' homes, etc., interesting and varied work with excellent opportunities for promotion on merit.

Five-day week. Housing accommodation may be provided for a limited period. Removal expenses allowed.

Forms of application from the City Architect, P.O. Box 488, Town Hall. Returnable by 7th February, 1961. 7466

LONDON ELECTRICITY BOARD

Engineer (Meter)

APPLICATIONS are invited for the above position in the Meter and Test Branch of the Chief Engineer's Department at Effie Road, Fulham, London, S.W.6.

Applicants should preferably hold the Higher National Certificate and should have up-to-date experience in the repair and testing of large quantities of meters and in the control of staff.

The post is graded under Schedule B of the National Joint Board Agreement as Grade 8, Class BX, salary range £1,155 to £1,460 per annum, inclusive of London allowance.

Application form, obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref. PER/V/3134/R. 7451

AEI

Associated Electrical Industries Limited

INSULATION DEVELOPMENT

GRADUATE ELECTRICAL ENGINEER required for interesting work on the development of insulation systems for rotating machines. The work involves the evaluation of insulation materials and systems using model systems such as motorettes, and there is scope for initiative in developing new testing techniques. Some previous experience in this field would obviously be an advantage but it is not essential; enthusiasm would be equally acceptable.

Please write for application form, quoting reference G.18 to :—

Personnel Manager
Associated Electrical Industries (Manchester) Ltd.
Trafford Park, Manchester, 17

7472

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

THIRD ASSISTANT ENGINEERS

(a) Southend District, Essex Sub-Area (9/61.R.).

(b) North Essex District, Essex Sub-Area (10/61.R.).

(c) Stevenage District, Northmet Sub-Area (12/61.R.).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, including substations.

Salary: (a) N.J.B. Class H, Grade 9 (£1,040/£1,165); (b) N.J.B. Class F, Grade 9 (£890/£1,015); (c) N.J.B. Class G, Grade 9 £965/£1,090).

Apply by letter by 10th February, 1961, to:—

(a) J. Linton, A.H.W.C., M.I.E.E., A.I. Mech.E., Manager, Southend District, Eastern Electricity Board, 85, London Road, Southend-on-Sea, Essex.

(b) J. C. Horrell, M.I.E.E., Manager, North Essex District, Eastern Electricity Board, Cressing Road, Braintree, Essex.

(c) H. L. Sumner, Manager, Stevenage District, Eastern Electricity Board, Walkern Road, Stevenage, Herts.

Suffolk Sub-Area

DEMONSTRATOR

BURY ST. EDMUNDS DISTRICT (11/61.R.).

Candidates should have had domestic science training including electrical housecraft; should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations including lectures and advice to consumers on the utilisation of domestic electrical apparatus.

Salary N.J.C. Grade 1 (£600-£700).

Apply by letter to H. B. Rendle, A.M.I.E.E., Manager, Bury St. Edmunds District, Eastern Electricity Board, 4, Cornhill, Bury St. Edmunds, Suffolk, by the 20th February, 1961.

7486

POWER HOUSE ENGINEERS

required by **Air Ministry** for 2-year tour in Aden under contract; some family accommodation available for married men. Starting salary is according to age, qualifications and experience and ranges from £715 at age 22 to £875 at age 28 or over, rising to max. of £975. Tax free foreign service allowance in addition to salary varies according to marital status and whether or not official accommodation is occupied, viz.:—

Single :—
  Accommodated £200 p.a.
  Unaccommodated £455 p.a.

Married :—
  Accompanied and in official accommodation £755 p.a.
  Accompanied and in private accommodation £1,190 p.a. and excess rent.
  Unaccompanied and in private accommodation £815-£855 p.a.
  Unaccompanied and in official accommodation £560 p.a.

Kit allowance and free passage overseas, also free passages for family, when private or official accommodation arranged. Free medical and educational arrangements and good sports facilities. 5-day week with 18 days' paid annual leave. Paid sick leave within certain limits.

Candidates must have had indentured apprenticeship of not less than 3 years, served preferably with a manufacturer of diesel engines of 300-2,000 b.h.p. Also not less than 5 years' experience following apprenticeship, at least 2 years of which should have been in a power house containing diesel engine-driven alternators. Experience of parallel running of alternators and of planned maintenance of power house plant would be an advantage. Preference given to candidates holding O.N.C. (Mech.) or equivalent.

Applicants, who must be natural-born British subjects, should write stating age, qualifications and experience to Manager (PE.520), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon St., London, E.C.4. Selection will be by interview in London and some expenses entailed will be reimbursed.

268

K & L STEELFOUNDERS AND ENGINEERS LIMITED

Letchworth, Hertfordshire

One of the 600 Group of Companies

ELECTRICAL ENGINEER

WE wish to appoint a man to deal with a connected load of 25,000 kVA over a wide variety of plant and machinery.

Responsibility for all aspects of electrical engineering activity directly to the Works Engineer.

Applicants, in the age range 25-35, should have had a sound practical training and possess a recognised qualification.

The position offers an excellent opportunity for gaining experience and advancement.

Starting salary not less than £1,100 per annum. Progressive staff conditions include pension scheme, and some assistance can be offered with housing.

Applications, in confidence, giving a concise account of background and career to date, should be addressed to the Personnel Director.

7449

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

KINGSTON POWER STATION ELECTRICAL MAINTENANCE ENGINEER (Vacancy No. 30/61).

The successful candidate will be responsible for the organisation and efficient working of the electrical maintenance department in a high merit station.

Applicants should have had experience in the maintenance of heavy electrical plant and switchgear and should possess the H.N.C. in Electrical Engineering (Power). Experience in the control of labour is desirable.

The station is pleasantly situated on the banks of the River Thames near to a good shopping centre. Good educational facilities are available in the area.

Salary N.J.B. Class G, Grade 6, £1,240 to £1,375 per annum including London allowance.

Applications giving age, details of experience, qualifications, etc., and quoting vacancy number, should be sent to the Station Superintendent, Kingston Power Station, Down Hall Road, Kingston-upon-Thames, Surrey, to arrive by 6th February, 1961.

7488

AEI

Associated Electrical Industries Limited

Turbine-Generator Division, Manchester

ELECTRICAL and MECHANICAL ENGINEERS and DRAUGHTSMEN

Associated Electrical Industries, Turbine-Generator Division, have vacancies at Trafford Park for experienced ELECTRICAL and MECHANICAL ENGINEERS and DRAUGHTSMEN for the investigation of special features associated with the development of large high speed turbo-type generators.

There are also vacancies for engineers and draughtsmen with some experience in the design of rotating electrical machines.

Please write for application form, quoting reference C.18 to:—

Personnel Manager
Associated Electrical Industries (Manchester) Ltd.
Trafford Park, Manchester, 17

7457

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

THIRD ASSISTANT DISTRICT ENGINEER, EDINBURGH EAST DISTRICT.

Salary N.J.B. Schedule A, Class G, Grade 9, Salary Scale No. 7, £965/£1,090 p.a.

Applications on the standard form, obtainable from the undersigned, should be submitted not later than 10th February, 1961.

Conditions of service will be in accordance with the N.J.B. Agreement, and the successful candidate will require to become a contributor to the Board's superannuation scheme.

Applicants should have a sound training and subsequent experience with H.V. and L.V. underground distribution systems, including the operation and maintenance of H.V. and L.V. switchgear and cable, and a knowledge of protective gear and fault location. The possession of a National Certificate in Electrical Engineering or an equivalent qualification is desirable.

The successful candidate will require to reside within a reasonable distance of District Headquarters.

C. H. A. COLLYNS,
Manager.

52, Melville Street,
Edinburgh, 3.

7443

SOUTH WALES ELECTRICITY BOARD

General Assistant Engineer

APPLICATIONS are invited for the position of GENERAL ASSISTANT ENGINEER in the Swansea District of the Swansea and West Central Area.

Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Salary N.J.B. Class G, Grade 9, Scale 7 (£965/£1,090 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to G. R. T. Edwards, B.Sc., M.I.E.E., M.Am.I.E.E., Manager, Swansea and West Central Area, 29, Ystrad Road, Swansea Industrial Estate, Swansea, to arrive not later than 11th February, 1961. Please quote reference 4/61/ER, endorsing envelope "General Assistant Engineer."

R. G. WILLIAMS,
Secretary.

7479

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointments in the System Operation Department, Thames North Grid Control Centre, Redbourn, near St. Albans, Herts.

(a) THIRD ASSISTANT ENGINEERS (S.V. No. 1397). Salary N.J.B. Class BX, Grade 8, Scale 11, £1,105-£1,410 per annum plus 10% shift allowance.

(b) FOURTH ASSISTANT ENGINEERS (S.V. No. 1398). Salary N.J.B. Class BX, Grade 9/11, within the range of Scales 8/10, £855-£1,325 per annum.

The commencing salaries will be within the above ranges at points commensurate with qualifications and experience. The minimum technical qualification required is the Higher National Certificate in Electrical Engineering.

Some generating station and/or transmission/technical experience is essential in the case of appointment (a) and is desirable for appointment (b). The successful applicant in the case of appointment (a) will be required to undertake shift duties in the Grid control room. In the case of appointment (b) the duties are on day work and are of a general technical and statistical nature. but applicants must be prepared ultimately to undertake shift duties in the Grid control room.

Forms of application (AE.6/ACT) may be obtained from the Board's Headquarters, or from any Divisional Offices of the Board, and should be addressed to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 11th February, 1961, quoting the appropriate reference S.V. No. 7458

PIONEER ELECTRIC CANADA

SENIOR TRANSFORMER DESIGN ENGINEER wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience 10 years in design of 5-kVA to 50-MVA transformers.

SWITCHGEAR DESIGN ENGINEER wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience 5 years or more in design of metalclad and metal-enclosed switchgear up to 15 kV, with some knowledge of high-voltage circuit breakers preferred.

Pleasing personalities and energetic attitudes essential. Positions of particular interest to young engineers desiring to join a new and rapidly expanding organisation where working conditions and job opportunities are good.

Attractive salaries, depending upon qualifications.

Full details re education and experience to :—

PIONEER ELECTRIC LIMITED
1, Rockwood Place, Winnipeg, 9
Manitoba, Canada

7264

WOKING URBAN DISTRICT COUNCIL

Maintenance Electrician and Engineer

(Miscellaneous Grade V, £685-£760
plus £60 for overtime)

APPLICATIONS are invited for the above post at the Council's Sewage Works and Pumping Stations.

Housing accommodation is provided (present rent £1 11s. 8d. per week, inclusive).

Form of application and conditions from Engineer and Surveyor, Council Offices, Woking.

Closing date, 8th February, 1961. 7444

HONG KONG

A LARGE North American company operating in the Far East requires OVERHEAD LINE ENGINEER for sales development work on aluminium overhead conductors. Successful applicant will reside in Hong Kong but will be required to travel extensively throughout the Far East.

Applicants must hold University Degree or equivalent qualification in electrical engineering and have minimum five years' experience in transmission and distribution line design and erection. Previous overseas experience an advantage. Age limit 28-35, but relaxable in special cases.

Salary commensurate with age and experience, but not less than £2,250 per annum. Unfurnished accommodation available at "nominal" rental Medical benefits. Six months' home leave after 3 years' service with return air passages paid by company. Pension scheme.

Write giving full details of age, experience and qualifications to Box F.207, c/o Streets, 110, Old Broad Street, London, E.C.2. 7447

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

GENERAL ASSISTANT ENGINEERS (SEC/3.128)

APPLICANTS should have served an apprenticeship or had practical training suitable to the industry. They should possess a sound general and technical education and preference will be given to those possessing a Higher National Certificate (or those nearing completion of H.N.C. courses). Opportunities are available for general assistant engineers to complete their studies and gain wide experience with good prospects of promotion.

The duties of those appointed will vary but will come under one of the following main headings:—

(a) The construction of transmission lines and substations and the operation and maintenance of overhead lines, cables and associated transmission equipment.

(b) Work associated with protection, communications and electrical plant maintenance.

(c) Operation and/or maintenance of generating station plant including instrument engineering.

Those with good technical qualifications who have not had experience under the above headings will be considered for vacancies as technical staff trainees for appropriate periods prior to appointment as general assistant engineers.

Salary for general assistant engineers, N.J.B. Scales 2-5, £670-£940 according to experience.

Special application forms obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 8th February, 1961. 7489

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

North Caledonia Area

SECOND ASSISTANT ENGINEER (Planning and Protection).

Applications are invited for the above superannuable post at Area Office, Elgin, Morayshire. Experience required in the planning of urban and rural distribution networks, and the design of substations at voltages up to and including 33 kV. Candidates should preferably be Corporate Members of the Institution of Electrical Engineers or have qualifications leading to this. Salary and conditions of service in accordance with N.J.B. H.6 or H.7, £1,275-£1,410, or £1,190-£1,325 per annum according to experience.

Application form, obtainable from the Area Manager, West Villa, South Street, Elgin, should be returned by 13th February, 1961.

7500

LONDON ELECTRICITY BOARD

APPLICATIONS are invited for the undernoted positions :—

ENGINEERING DRAUGHTSMAN
(Ref. PER/V/3186/R),
Surrey Suburban District,
Durnsford Road, Wimbledon,
London, S.W.19.

Candidates should have a good general and technical education and be in possession of the Ordinary National Certificate, be neat and capable draughtsmen, and be experienced in one or more of the following subjects: drawing office routine, electrical diagrams, layout of plant in transformer chambers, mains survey and recording of mains work.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 13, £815 to £920 per annum, inclusive of London allowance.

DRAUGHTSMAN or DRAUGHTSWOMAN
(Ref. PER/V/3185/R),
Northern District,
18/24, Lower Clapton Road,
Clapton, London, E.5.

Applicants should have had previous drawing office experience, preferably with a public utility authority. The successful candidate will be required to prepare drawings of mains layouts, system diagrams and permanent records.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 2, i.e., £700 to £775 per annum, plus the appropriate London Area allowance.

Applications, in writing and quoting ref. no., should be addressed to the appropriate District Manager, within 14 days of the publication date of this notice. 7437

CHIEF RESEARCH AND DEVELOPMENT ENGINEER

APPLICATIONS are invited from Electrical Engineers for this important appointment with a medium-sized, independent and old-established company in the North-West, manufacturing high-speed lifting equipment.

An engineering degree, preferably honours, or equivalent qualification is essential. Experience of electronic motor controls, switching circuits and other ancillary equipment essential.

Age preferably not over 40. Salary up to £2,000 (or more) according to qualifications and experience.

Full details, quoting Ref. V4304 B, should be sent to:—

The Registrar
PROFESSIONAL ENGINEERS
APPOINTMENTS BOARD
201 High Holborn
London, W.C.1

7473

ELECTRICAL ENGINEERS

Salary Scale £910 × £35(1) × £40(2) × £45(5) × £50(7) to £1,600 p.a.

APPLICANTS should be Corporate or Graduate Members of the Institution of Electrical Engineers, and have a wide experience in design, estimating and preparation of specifications and schedules to cover all types of electrical installation work, including power, lighting, heating, lifts, call systems, telephones.

Graduate I.E.E.'s enter at minimum of salary scale and their maximum salary will be £1,205 until Corporate membership is attained. Corporate members can be considered for a starting salary between £1,160 and £1,300 depending on experience.

Applications stating age, qualifications, experience, present and previous appointments and the names of three referees, should be forwarded to the Secretary, Western Regional Hospital Board, 351, Sauchiehall Street, Glasgow, C.2. 7487

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

Third Assistant Engineer (Site Progress)

APPLICATIONS are invited for the appointment of THIRD ASSISTANT ENGINEER (Site Progress) at Aberthaw Power Station.

Candidates should preferably possess a Higher National Certificate in either mechanical or electrical engineering and have served a recognised engineering apprenticeship. Experience on the construction of heavy plant as installed in modern power stations either in a manufacturer's works or on site is essential, and a knowledge of the civil engineering work involved would be an advantage.

The selected candidate will be required to maintain up-to-date charts on the progress of the works on site in accordance with previously agreed programmes and to assist the Resident Engineer in anticipating any divergence from these programmes. Ability to co-ordinate with Regional P.I.T. Officers will be required.

The salary will be within Grade 7, Scale 13 (£1,285 - £1,610 per annum) of the National Joint Board Agreement.

Applications should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, Birmingham, 30, and should be returned to him not later than 6th February, 1961.

Envelopes should be marked "Confidential," Staff Vacancy No. MPG.3/61. 7434

SOUTH WALES ELECTRICITY BOARD

Principal Assistant (Expenditure)

APPLICATIONS are invited for the position of PRINCIPAL ASSISTANT (Expenditure) in the Cardiff and East Central Area of the Board.

The person appointed will be required to take control of the Expenditure Section and therefore have experience of wages, stores accounting, costing and the provision of comprehensive management statistics. Applicants must be prepared to advise on improving systems used in the department. The possession of a professional accountancy qualification will be an advantage.

Salary N.J.C. Grade 8 (£1,380/£1,500 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, Assoc.I.E.E., Manager, Cardiff and East Central Area, 445/447, Cowbridge Road East, Cardiff, to arrive not later than 11th February, 1961.

Envelopes should be endorsed "Principal Assistant (Expenditure), 6/61."

R. G. WILLIAMS,
Secretary.

7478

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT MAINTENANCE
ENGINEER (Electrical),
WEST HAM POWER STATION
(Vacancy No. 61/44).

Sound practical and technical training necessary, with previous experience of power station electrical maintenance desirable. Previous applicants will be considered and need not re-apply. Salary Class H, Grade 8 = £1,165-£1,295 per annum.

Applications, quoting vacancy number, to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box No. 136, London, W.1, by 7th February, 1961. 7467

LONDON ELECTRICITY BOARD

Eastern District

APPLICATIONS are invited for the undernoted positions at 84, Romford Road, Stratford, E.15.

ASSISTANT DISTRIBUTION
ENGINEERS.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of engineering work associated with the organisation of a district distribution department.

The posts are graded under Schedule A of the National Joint Board Agreement as Class J, Grade 14, £815 per annum rising to £920 per annum, inclusive of London allowance.

GENERAL ASSISTANT ENGINEERS.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the electricity industry, or have equivalent experience.

Pending determination as to the grading and salary applicable to the posts within the National Joint Board Agreement, the provisional minimum salary will be £685 per annum rising to £855 per annum, inclusive of London allowance.

Applications in writing should be sent to the District Manager at the above address. Please quote ref. PER/V/3110/R. 7499

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

FOURTH ASSISTANT ENGINEERS TECHNICAL DEPARTMENT

APPLICATIONS are invited for the above appointments in the Reading and Melksham areas.

Duties will include the installation and maintenance of automatic telephone type equipment including applications in telephony, supervisory and remote control system. Knowledge of V.F. line signalling technique and an acquaintance with electronic or V.H.F. radio would be an advantage.

Applicants should preferably possess an appropriate Higher National Certificate or equivalent qualifications.

Salary N.J.B. Grade AX.11, £855-£1,090.

Special application forms (not AE6/ACT) obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by Wednesday, 8th March, 1961.

7459

TELEPHONE TECHNICIANS: OVERSEAS/U.K. SERVICE

CABLE AND WIRELESS Limited require TELEPHONE TECHNICIANS for service at some overseas branches.

Duties include supervision of construction of external lines (overhead and underground) and installation of subscribers' station apparatus; planning of subscribers' networks, and ordering of materials.

Applicants, aged 20/30, must hold a minimum of 5 "O" level passes in G.C.E., including English, Mathematics and Physics, or appropriate C. and G. certificates. Preference given to those with knowledge of Strowger type exchanges and multi-channel carrier line systems. Full information, including pay and allowances, will be given at interview.

There is also an administrative vacancy for an ASSISTANT ENGINEER with similar background in the company's head office in London.

Write giving details of qualifications and experience to Staff Manager, Cable and Wireless Limited, Mercury House, Theobalds Road, London, W.C.1. 7471

NORTH WESTERN ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER,
TELECOMMUNICATIONS SECTION,
SUB-AREA ENGINEERING DEPT.,
MANCHESTER.

The duties will include assisting in the commissioning and maintenance of Sub-Area supervisory control and automatic telephone equipments, and an adequate technical training, together with practical experience of telephone installations, is required.

Salary scale £765-£870 p.a., Grade M.17. N.J.B. conditions.

FOURTH ASSISTANT DISTRICT
COMMERCIAL ENGINEER
(TECHNICAL SALES AND SERVICE),
EAST DISTRICT,
CHORLTON-ON-MEDLOCK,
MANCHESTER.

Applicants should be capable of assisting the Technical Sales and Service Engineer in connection with industrial and commercial matters. Good technical training essential.

Salary scale £765-£870 p.a., Grade H.13. N.J.B. conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 6th February, 1961. 7496

SOUTH WALES ELECTRICITY BOARD

District Manager, East Monmouthshire District

APPLICATIONS are invited for the post of MANAGER of the East Monmouthshire District in the Monmouthshire and Mid-Wales Area.

The District has its main office in the new town of Cwmbran and is varied in character, having an important industrial and urban load based upon Pontypool and the adjoining valleys, together with a large rural area to the east of the District, including the Usk and Wye Valleys.

Experience in a senior position in the electricity supply industry is essential, and applicants should possess a recognised professional qualification.

The salary for the position will be in accordance with Class C, Grade 5 of the National Joint Managerial and Higher Executive Grades Committee, namely £2,170-£2,380 per annum.

Applications should be sent to the undersigned at St. Mellons, Cardiff, to arrive not later than Saturday, 18th February, 1961.

Please quote reference 7/61/SVN, endorsing envelope "District Manager, East Mon."

R. G. WILLIAMS,
Secretary.

7477

TECHNICAL

SALES REPRESENTATIVE

SWITCHGEAR

required by leading manufacturers of low and medium-voltage electrical switchgear and distribution equipment.

This is an exceptionally good opportunity for the right man, who should preferably be under 36, reside in or near Manchester and have been technically educated to H.N.C. standards. Other essentials are boundless enthusiasm and a good electrical sales record with consulting engineers, contractors, electricity boards and local authorities in the North-West. The company operates a pension scheme for its employees.

Full details, in strict confidence, to:—

THE SALES DIRECTOR
BOX NO. 7389

***Situations Vacant** (continued)*

SOUTHERN ELECTRICITY BOARD

Planning Engineer

Portsmouth District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class J, Grade 6 (£1,350-£1,500 per annum). N.J.B. conditions of service.

The duties of the post will include the preparation of schemes and estimates for extensions and/or reinforcements to overhead and underground networks up to and including 33 kV. The appointment will involve standby duties.

The successful applicant will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.1305, not later than 6th February, 1961. 7492

W. E. SYKES LIMITED

An expanding Machine Tool programme enables us to invite applications for the following posts :—

Electronic Designer/Draughtsman

for design and development work on electronic test gear, machine tool control gear and electro-mechanical devices. Knowledge of basic electronic circuit theory is essential.

Electrical Draughtsman

for work on machine tool control gear and electro-mechanical assemblies. Training available.

Generous salaries, excellent prospects, non-contributory pension scheme.

Write giving details of age, education, experience and salary to Personnel Officer, W. E. Sykes Ltd., Manor Works, Staines, Middlesex. 7432

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR SERVICE CENTRE ASSISTANT required at Whitchurch. Salary within range £600/£700 per annum (N.J.C. Grade 1).

Applicants should have a sound knowledge of modern electrical appliances and of the electrical retail trade. Duties will include responsibility for the service centre, sales of appliances, advice to consumers, window display and receipt of accounts.

Appointment subject to medical examination. Pension scheme.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, nr. Wrexham, or from any District Office. Closing date 6th February, 1961.

Previous applications remain under consideration. 7493

PRODUCTION MANAGER

WELL-known manufacturers of small electrical equipment in South of England, employing 150/200, require ENGINEER age 30 to 40 to take charge of production with a view to ultimate position as Works Manager. Production engineering and light engineering machine shop experience essential. Electrical background and technical or production certificates desirable. Generous salary and good prospects.

Replies stating qualifications and salary expected.—Box 7380.

ENFIELD-STANDARD POWER CABLES LTD.

urgently require the following staff :—

1. ACCOUNTS CLERKS.
2. NATIONAL MACHINE OPERATOR.
3. ASSISTANT CHEMIST at H.N.C. level.
4. JUNIOR CHEMIST at O.N.C. level.
5. JUNIOR COPY TYPISTS (some experience)

and

Young ELECTRICAL ENGINEERS for installation contracts throughout the U.K. (H.N.C. or H.N.D. preferred).

Apply Personnel Manager, Enfield-Standard Power Cables Limited, Millmarsh Lane, Brimsdown, Middlesex. 7468

TECHNICAL SALES ENGINEER

required by old-established manufacturer of Rotary Electrical Equipment.

The candidate should have considerable knowledge of electric motors and generators and their application, and should preferably hold the Higher National Certificate or equivalent qualification.

This is a senior appointment which will admit to the company's monthly staff pension scheme.

Please write, giving full particulars, to :

Sales Director
SMALL ELECTRIC MOTORS LTD.
Churchfields Road, Beckenham, Kent

7249

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division
(Vacancy No. ER/AV/13/61)

ASSISTANT SHIFT CHARGE ENGINEER required at East Yelland Power Station.

Superannuation scheme. Salary N.J.B. Class H, Grade 9, Scale 8, £1,040-£1,165 per annum plus 10% shift allowance.

Applicants should possess good technical qualifications and should have had training and experience in the control and operation of modern steam generating plant and main switchgear.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 8th February, 1961. 7491

TRANSFORMER TEST ENGINEER

to take charge of test dept. of small rapidly growing company making transformers up to 1,000 kVA. Good salary and excellent prospects for the right man. Some assistance with housing would be given if needed.

TRANSFORMERS & RECTIFIERS LTD.
Millmead, Guildford, Surrey 7268

SUPERVISING ENGINEERS

SUPERVISING ENGINEERS, both Electrical and Mechanical, are required by the War Department throughout the South of England. Candidates must have a sound engineering background with experience in the maintenance of electrical and/or mechanical installations.

Minimum technical qualifications required are Ordinary National Certificate (E. or M.) or equivalent.

Starting pay (on a scale of £770 to £950) is based on age, qualifications and experience.

Prospects of establishment and promotion. Normal week 42 hours (net).

Apply stating age and full details of training and experience to Command Works Officer, H.Q. Southern Command, Wilton, Salisbury, Wilts., from whom further information may also be obtained. 7435

LIGHTING SALES ENGINEER

required. London office. This is a senior appointment and the successful applicant must have lighting knowledge and experience, preferably Dip.M.I.E.S. or City and Guilds Intermediate Illumination. This progressive position requires a man of ability who is used to dealing with clients on an executive level. Car provided. Salary according to experience.

Write to Sales Director, Courtney, Pope (Electrical) Ltd., Amhurst Park Works, Tottenham, London, N.15. 7433

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT SECTION ENGINEER required in the Chester District. Salary within range £1,040/£1,165 per annum (N.J.B. H/9).

Applicants should have had experience in the construction and operation of overhead and underground distribution systems up to 33 kV, including indoor and outdoor substation equipment, and be in possession of appropriate technical qualifications.

Appointment subject to medical examination. Pension scheme.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate Street, Chester, must be forwarded not later than 6th February, 1961. 7494

DEPUTY ENGINEER

required for Ghana by leading British merchant's house. To be fully qualified electrical engineer with commercial and practical experience overseas in a wide range of electrical equipment and to act as deputy to Ghana engineering manager. Preferably under 36 years of age. Commencing salary £1,500/£1,800 depending upon experience, plus commission, free partly-furnished accommodation, provident fund, etc. Full personal particulars and experience, to—Box 7429.

MIDDLESEX COUNTY COUNCIL

Education Department

LABORATORY STEWARD required at Twickenham Technical College, Egerton Road, Twickenham, Middx., for electrical machines and power laboratory which is equipped with comprehensive range of apparatus, including automatic control machines. Should have knowledge of electrical machines or power equipment and be able to use initiative in setting up and maintaining such equipment. Salary Misc. V, £685 - £760 plus London weighting of up to £40. 38-hour week. Prescribed conditions. Write to Principal, above address, by 14th February. Quote F.353ER. 7490

NATIONAL INSTITUTE FOR RESEARCH IN DAIRYING

Engineering Department

A TESTING OFFICER is required for performance testing of dairy machinery. Applicants should preferably have experience of engineering testing work and an educational qualification to H.N.C. standard.

The appointment will be made in the Experimental Officer grade, the salary scale for which is £1,057-£1,296 p.a. with superannuation.

Applications stating qualifications and experience, age and present appointment, to the Secretary, N.I.R.D., Shinfield, Reading, quoting ref. 61/3. 7497

KLIPPON ELECTRICALS LIMITED

Sales Engineer for Birmingham Area

AN opportunity exists for you to take up an interesting and rewarding career of selling with a progressive manufacturing company.

Applicants should have an electro-technical background and preferably some experience in selling.

Applications giving full details should be addressed to W. Fox, Esq., Klippon Electricals Ltd., Norfolk House, 28, Norfolk Street, Strand, London, W.C.2. 7495

POWER PLANT OPERATORS

for new iron ore development project in West Africa. Experience with Hawker Siddeley Brush power plant equipment desirable. Three months' vacation upon completion of two-year contract. Contracts will start early in 1961.

Applicants must pass rigorous physical examination and investigation of character and ability.

Write to Mr. M. Browne, Wm. H. Muller & Co., 52, Lime Street, London, E.C.3. 7393

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT SECTION ENGINEER required in the Conway Valley District of the Board's No. 4 Sub-Area. Salary within the range £825/£940 per annum (N.J.B. E/9).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium-voltage networks, with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham. Closing date, 6th February, 1961.

Previous applicants need not re-apply. 7470

MEASUREMENT AND EVALUATION OF ELECTRICAL INSTALLATIONS

A VACANCY occurs for a competent ESTIMATOR AND MEASURING SURVEYOR for interesting industrial installations.

Applications in writing in the first instance stating age, experience and salary required, etc., to FRANK N. FALKNER & PARTNERS, Chartered Quantity Surveyors, Windscale Works, Seascale, Cumberland. 7361

A WAREHOUSE man/counter hand wanted. Good wages and prospects.—Kenroy Ltd. (Wholesalers), 152, Upper Street, London, N.1 (CAN. 6671). 7485

DEVELOPMENT engineer required for work on contactors and electro-mechanical devices. O.N.C. minimum requirement. Good prospects with expanding company.—Dewhurst & Partner Ltd., Raans Road, Amersham, Bucks. 7436

DRAUGHTSMAN for high-voltage substation work. Experience on protective and control gear wiring diagrams essential. The person appointed would have the opportunity to train in technical and contract engineering work on wide range of electrical equipment. Applications in writing to—Managing Director, Cruickshank & Partners Ltd., 100, Renfrew Street, Glasgow, C.2. 5002

DRAUGHTSMEN, junior and senior, required for small firm manufacturing fuse and switch gear, London, Kilburn area. Write full details and salary required.—Box 7438.

ELECTRIC control gear engineer/draughtsman, experienced in circuitry for heating, ventilating and oil burner controls, required by consulting engineers. Candidates should have at least a Higher National Certificate or Grad. I.E.E. Apply stating qualifications and experience to—Kennedy & Donkin, 12, Caxton Street, London, S.W.1 (ref. FBT/WBH). 236

ELECTRICAL engineer, preferably with small motor design experience, required by a progressive London firm of motor manufacturers.—Box 7454.

ELECTRICAL engineer required by consulting engineers, Piccadilly, London, age about 30. H.N.C. and some years' experience of heavy equipment essential. Comm., sal. and bonus about £1,100. Pensionable post. Reply with full details to—Box F.172, c/o Streets, 110, Old Broad Street, London, E.C.2. 7483

ELECTRICAL wholesalers invite applications from stores and clerical personnel with some knowledge of the trade, seeking a progressive position.—L.E.C., 92, Blackfriars Road, London, S.E.1. 7431

INSTRUMENT makers required, fully skilled and able to work to drawings and specifications. Apply—Personnel Officer, Decca Radar Limited, Shannon Corner, New Malden, Surrey, quoting ref. FD/527/4. 7498

INVOICE clerk, preferably with knowledge of electrical contractors' materials; good wages. Apply—Phœnix Electrical Co., 16-18, Marshalsea Road, London, S.E.1 (HOP 4834). 7484

LONDON consulting engineer requires intermediate electrical engineer/draughtsmen with experience of lighting and power installations. Applicants should state age, experience, qualifications and salary required. — Walter Bridges & Company, 37, Parliament Street, Westminster, London, S.W.1. 7430

MECHANICAL and/or electrical measuring surveyor required in quantity surveyors' office in Berkshire. Practical knowledge of M. & E. services essential. Experience of measuring desirable but not essential. Write giving full particulars to—Box 7342.

REPRESENTATIVE required by established Essex and North London wholesalers. Experienced man with contacts in contracting, retail and industrial fields preferred. Salary, commission and car allowance, also superannuation scheme. Write details, etc., to—Box 7344.

SALES engineer required for Leicestershire, Northamptonshire and Eastern Counties by leading firm of motor and gearbox manufacturers. Excellent prospects.—Box 7453.

SALES lighting engineer required by leading industrial lighting fittings manufacturers for London area, age 24-30, H.N.C. preferred, outside sales experience not essential. Car provided. Apply in writing to—F. W. Thorpe Limited. Welby Road, Hall Green, Birmingham. 7379

SUPERVISING engineer required, preferably about 25/30, experienced in preparation of estimates and specifications for lighting, heating and water heating schemes. Able to advise clients and supervise works. Applicants must have a thorough knowledge of contracting with particular reference to domestic and commercial installations. Vehicle provided. Expanding company, Kensington (London) area. Give age, details of experience and salary required to—Box 7392.

TEST room assistant required for factory in Home Counties producing all types of paper, rubber and plastic insulated mains and telephone cables. O.N.C. in electrical engineering standard. Previous experience desirable but not essential. Good prospects, canteen facilities and pension fund. Reply stating age, experience and salary required to—Box 7455.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

BOX 7104.—This vacancy has now been filled and advertiser wishes to thank all applicants for their interest.

SITUATIONS WANTED

EXPERIENCE COUNTS!

ELECTRICAL ENGINEER, 20 years manager to contractors, from enquiry to accounts, designing schemes, etc., wide personal connection with architects and consultants, wants change.—Box 5004.

ENGINEER requires sales management, or senior sales post, with company supplying the electronics industry. Extensive connection with designers and buyers throughout London and Home Counties. Experience in design of metal fabrications, woodwork, plastics and packaging.—Box 7702.

EXPERIENCED supervising engineer requires progressive position with electrical contractor. Experienced in estimating and carrying out contract to final account stage. 36 yrs. old. Midland area preferred.—Box 5003.

GRADUATE engineer, aged 25, Faraday House Diploma, graduate apprenticeship with leading electrical manufacturer, two years' experience since, seeks position in London area.—Box 7701.

ARTICLES FOR SALE

E R

By Order of the Secretary of State for War

SALE BY TENDER

APPROXIMATELY 800 tons of Bare Overhead Wire and Cable Electric P.I.L.C., located at No. 1 E.S.S.D., War Dept., Honeybourne, Wilts.

Tenders must be submitted by 17th February, 1961.

Applications for tender forms should be made to War Office, Directorate of Disposals, First Avenue House, High Holborn, London, W.C.1.

7452

ALWAYS SPECIFY AND USE

PORTAWAY

(REGD.)

FOR ELECTRICAL SAFETY

2 NORTH PARK ROAD
HARROGATE
YORKS

T A PORTAWAY - T N 3855

EARTHING EQUIPMENT LIMITED

TINNED COPPER TAPE
'FULGRIP' BONDING CLAMPS
and 'DYROD' EARTH RODS

Good delivery—send for illustrated Price List

144

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road. London, E.C.1 37

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd. London W4. 57

A.C. and D.C. slotmeters and quarterlies. Reconditioned, guaranteed 2 years. Repairs and recalibrations.—Victor Electric Co., South View, Sweet Hill, Patcham, Brighton, Sussex. London agents, phone Downland 4682 (Surrey). 5001

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish, vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

ALTERNATORS for sale from 1,100 kVA at 750 r.p.m. down to ½ kVA. Single and three-phase. All voltages. More than 150 machines in stock. Automatic regulators and switchboards available. — Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists. — Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT-breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

COMPLETE high-temperature oven, Sturdy Engr. Ltd., 400/3/50, 7.5 kW, 350° Cent. Dimensions 4′ 6″ × 4′ 6″ × 3′ 6″ deep.—Massey & Coggins Ltd., Bridge Road, Liverpool, 7. 7292

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

Articles for Sale (continued)

ELECTRIC motors and generating equipment.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 116

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

FLUORESCENT tubes reconditioned and guaranteed with a life as new from 7s. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Clive Street, Bury (Telephone, Bolton 7251). 212

FOR sale, good, unused and used machinery, including electric motors, A.C. and D.C. dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

FRACTIONAL h.p. motors, new, ex stock, A.C./D.C., Universal, B.T.H., Delco-Remy, G.E.C., Fracmo, Newman, Scophony. — Jeary Electrical Co. Ltd., 5, Lamb's Buildings, London, E.C.1. 126

GENERATING sets, portable or stationary, new and reconditioned. 1 to 100 kW, A.C. and D.C. — Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.G.1. 40

PREPAYMENT 1s. slot house service meters.—Universal Electrical, 217-221, City Road, London, E.C.1. 36

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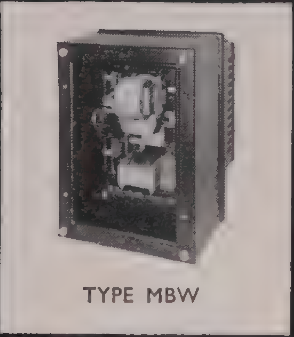

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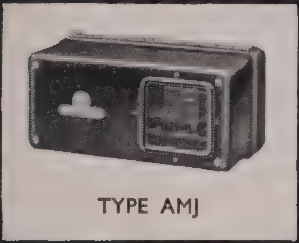

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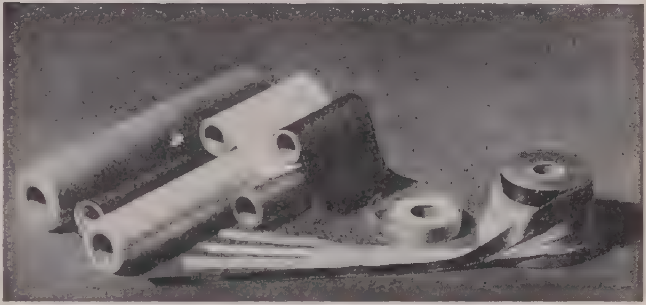

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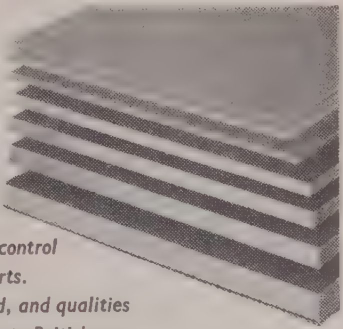

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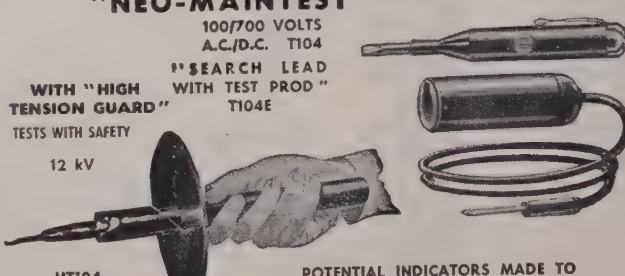

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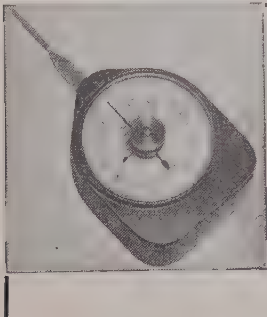

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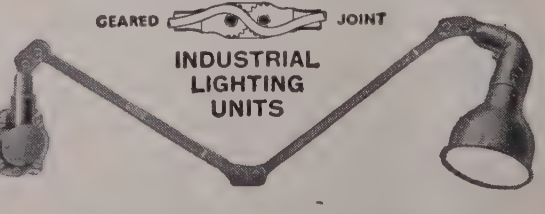

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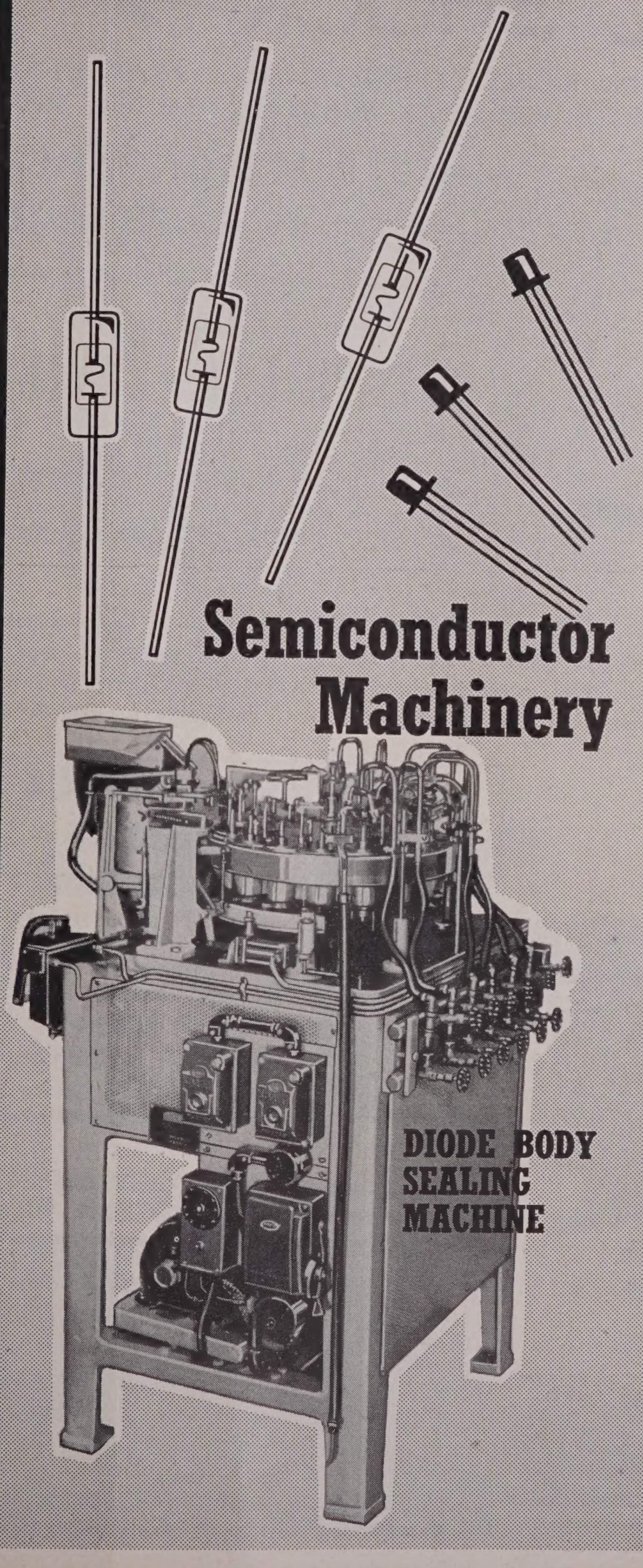

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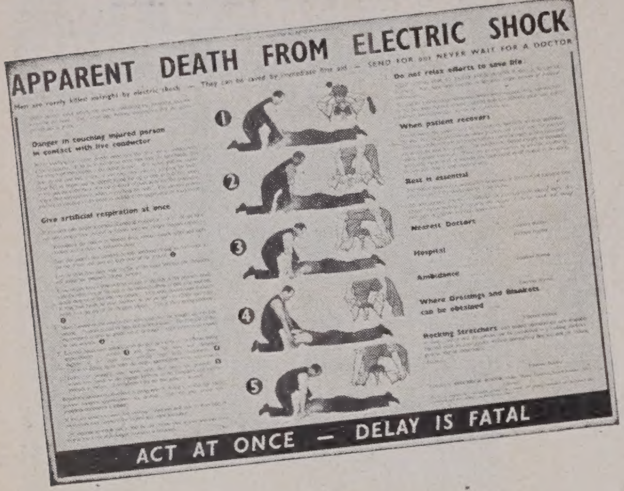

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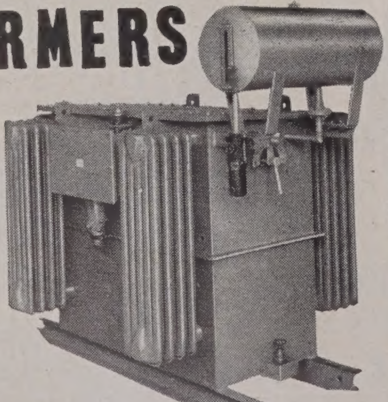

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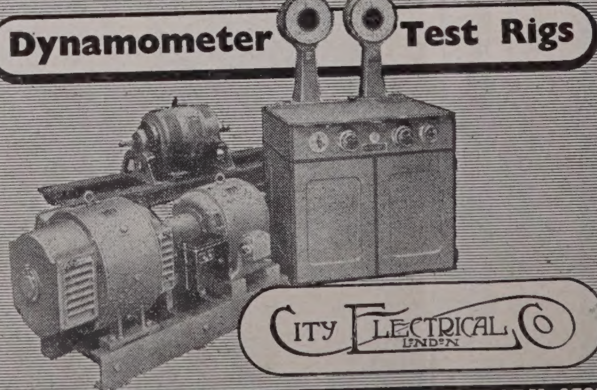

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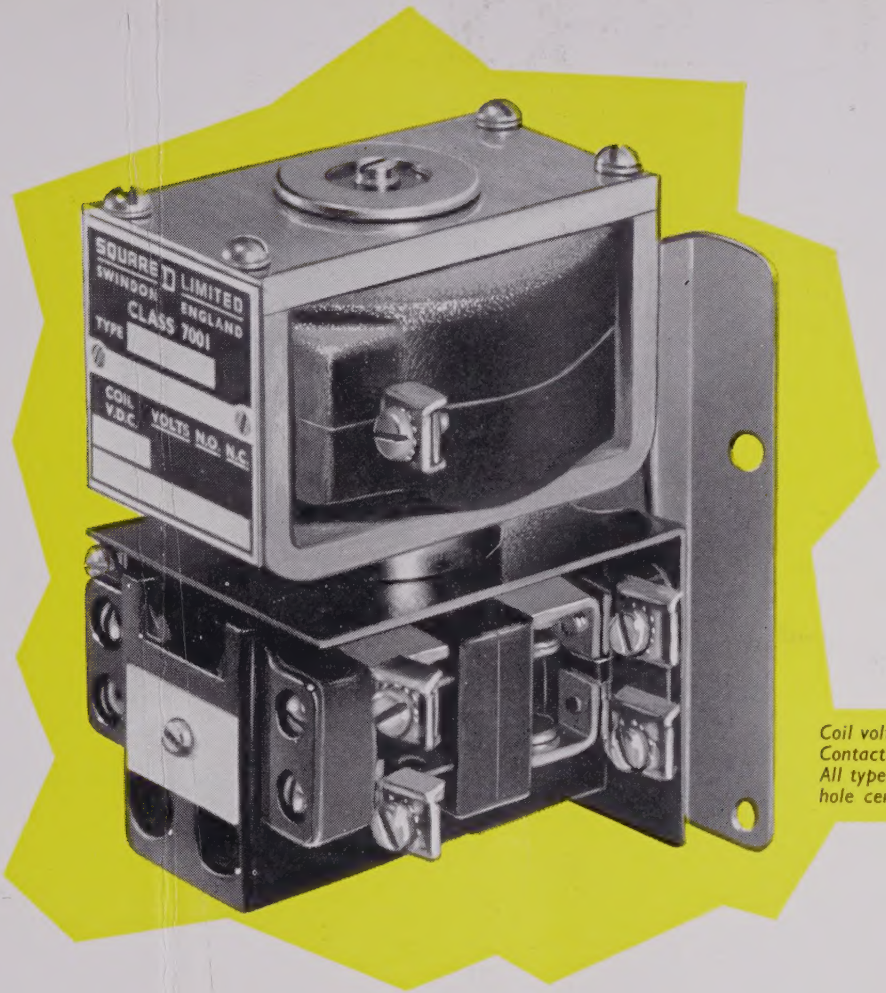

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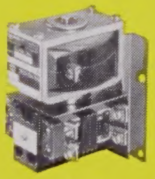

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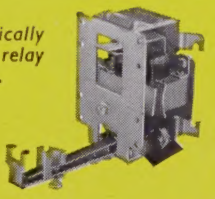
Build up your own mechanically held relays using standard DC relay and this Type M1 attachment.



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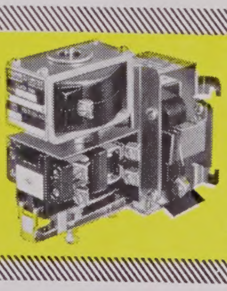
This mechanically held relay saves space! Same mounting hole dimensions as standard relay—mounts in same panel area.



HERE NOW!

are D.C. relays

THREE BASIC TYPES AVAILABLE

Up to 4 contacts (2 normally open 2 normally closed)
Up to 6 contacts (4 normally open 2 normally closed)
Up to 10 contacts (6 normally open 4 normally closed)
(or 8 normally open 2 normally closed)

- *Quick installation*
- *Take them apart from the front*
- *Moulded coil ensures long life*
- *Easy to wire—pressure wire connectors on all terminals*
- *Easy inspection and maintenance*
- *International market acceptance*

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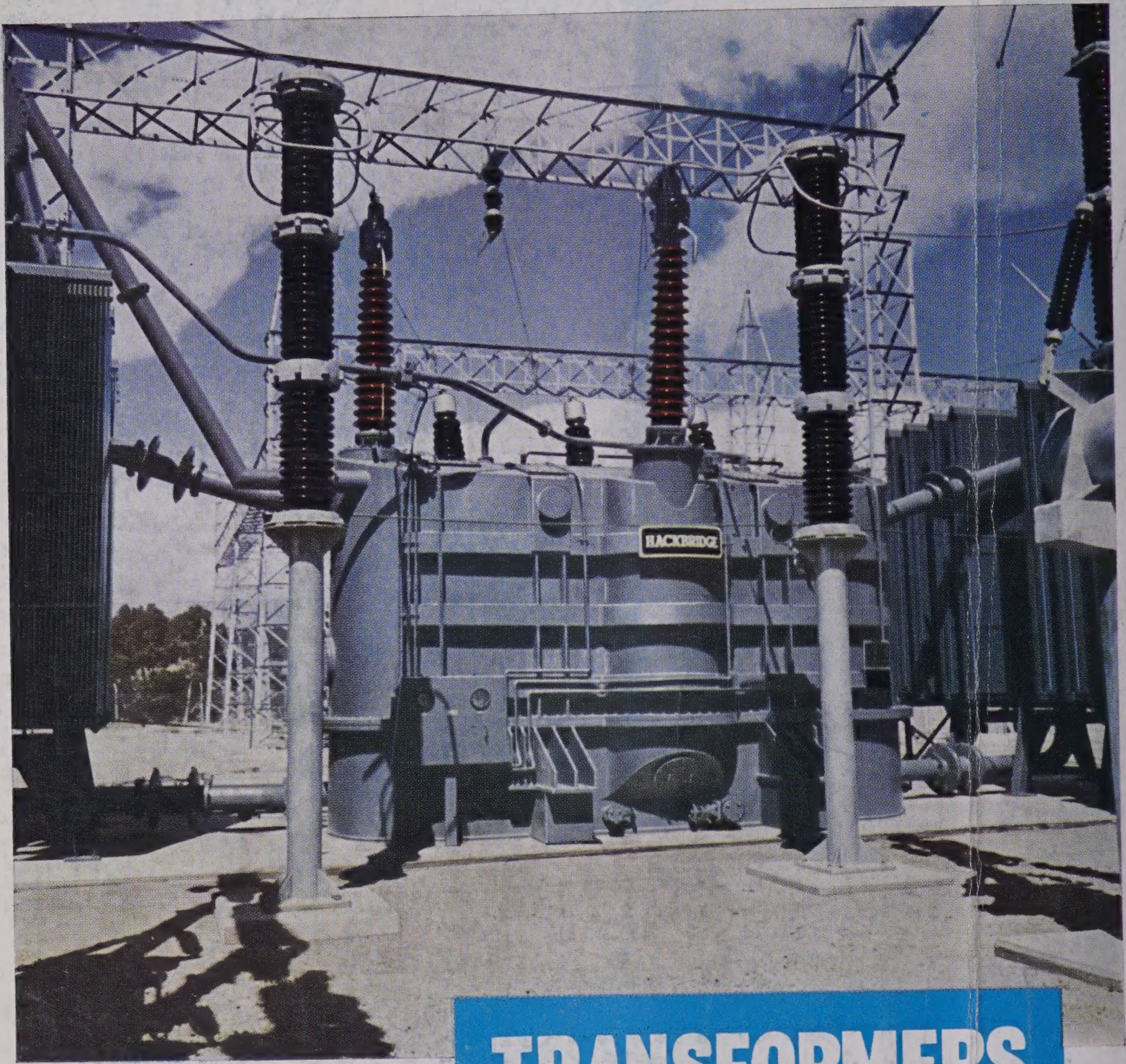

TRANSFORMERS
BY
HACKBRIDGE

One of three 100 MVA 220/110 KV Hackbridge transformers installed at the Chapel Street substation, Hobart, Tasmania Hydro Electric Commission

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